Materail food habits and infant feeding practices in Saudi Arabia

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MATERNAL FOOD HABITS AND INFANT FEEDING PRACTICES IN SAUDI ARABIA

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by

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Dedicated to my Family

In memory of my Grandparents,

my Aunt and my Cousin Huda

ABSTRACT

The aim of this study was to identify dietary patterns during pregnancy and lactation of Saudi Arabian mothers, together with infant feeding practices and identify the beliefs and other factors which lie behind these patterns. The implications for the nutritional health of mother and baby were also explored.

Data was collected in three separate studies:

1. An investigation of antenatal records of 92 mothers who had given birth to normal weight babies compared with records of 46 mothers who had given birth to babies weighing less than 2.500 kg.
2. Survey of dietary patterns and beliefs of 227 women attending the first antenatal appointment, recruited in Shaban (80), Shawal (76) and Ramadan (71).
3. A follow-up study of 51 mother-baby pairs to investigate dietary patterns, infant-feeding practices and anthropometric measurements at 1, 3, 6 and 9 months postpartum.

Results indicate the influence of cultural beliefs on maternal diet during pregnancy, puerperium and lactation, including some influence of hot/cold food classification. The period of Ramadan not only profoundly affected maternal eating habits in pregnancy, but was also associated with low birth weight when it fell in the second trimester of pregnancy. Based on 24-hour recall data, the diets of most mothers in pregnancy and lactation failed to meet international recommendations. Some breast feeding of infants was almost universal and prolonged by western standards, but the decline during the study period indicated that the majority would not comply with the Quranic injunction to breast feed for 2 years. Anthropometric data of infants indicated the presence of stunting/wasting in a small number of infants.

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INTRODUCTION

Maternal and infant health are usually held to be the cornerstones of good health in the community. Epidemiological and other studies have provided valuable insights into the factors which may put at risk the health of mothers and infants. However, health behaviour is culturally determined and the interplay and relative importance of such risk factors varies from one culture to another.

The contribution of nutrition to the successful outcome of pregnancy and optimal growth in the first years of life has been the focus, not only of extensive research, but also intervention through nutrition education, supplementation and other tools of nutrition policy.

In order to identify appropriate educational activities and establish priorities in the distribution of health and welfare resources, it is essential to have information available on the patterns of health and disease and the behaviours which give rise to them. But it is just as important to understand the beliefs and constraints which lie behind the behaviours associated with such patterns. In the case of Saudi Arabia, little published information is available concerning the dietary patterns of the population, particularly those during pregnancy and infant feeding practices, despite the fact that both its infant mortality rate and under-5 mortality rate (U5MR) are considered high (UNICEF, 1989). As a result, a series of studies have been undertaken in Saudi Arabia to investigate some aspects of diet in pregnancy and infant feeding practices in order to identify possible patterns of behaviour that may put the mother and infant at nutritional risk and to identify factors which may be behind the adoption of such eating and feeding patterns.

In order to put those studies into context, Chapter I provides background information on Saudi Arabia. Low Birth Weight (LBW) represents a particular hazard for the new-born infant and for this reason it is taken as an important indicator of health in the community. Chapter II reviews the factors associated with LBW, particularly aspects of maternal nutrition. This is followed with the results of a small study which examined the risk factors associated with LBW amongst mothers delivering at MC Hospital in Dammam, Saudi Arabia, based on routinely collected antenatal data.

Many factors may influence dietary patterns during pregnancy and these are reviewed in Chapter III, while Chapters IV and V report a study of the dietary habits of pregnant women in Saudi Arabia, and the influences which lie behind these, with particular reference to the influence of Ramadan.

Changes in infant feeding practices are of great concern, and Chapter VI reviews the factors which may influence mothers' decisions. This forms the background for the third study, during which 51 mother-infant pairs were followed up at intervals for 9 months. Maternal eating habits and infant feeding practices and anthropometric data were collected, as described in Chapters VII, VIII and IX. The implications of these study findings and recommendations are discussed in Chapter X.

CHAPTER I

SAUDI ARABIA - A BACKGROUND OF THE LAND AND PEOPLE

1.1 Introduction

Saudi Arabia is an independent monarchy ruled by His Royal Highness The King and his Council of Ministers, who are responsible for the national budget, national planning, social and economic development, defence, foreign affairs, and other matters.

The Kingdom of Saudi Arabia occupies a total area of 876,000 square miles (2.24 million square kilometres) and consists of five major provinces which are: Al-Hijaz, Najad, Al-Ahssa, Asir and Northern Province. Each one has an Emir (governor), who is appointed by royal decree. The Emir has to maintain the security in his province according to government regulations. Details of geography are found in the Map and Appendix I.

1.2. The Population

It is very difficult to obtain accurate population figures for Saudi Arabia, because records are not kept for the high number of people who live in the Bedouin areas and in isolated villages. Figures from UNICEF suggest a population of 12.6 million in 1989. This compares with a figure of 6.9 million reported by the Central Department of Statistics in 1975 (CDS, 1975). Table 1.1 indicates the distribution of this population between urban, rural and nomadic groups.

In spite of the uncertainties of this population data, it is apparent that a substantial proportion of the population of Saudi Arabia is now urbanised, a figure of 75% is reported by UNICEF (1989).

From:- Kay, S. & Malin, B. (1979).
Saudi Arabia Past and Present

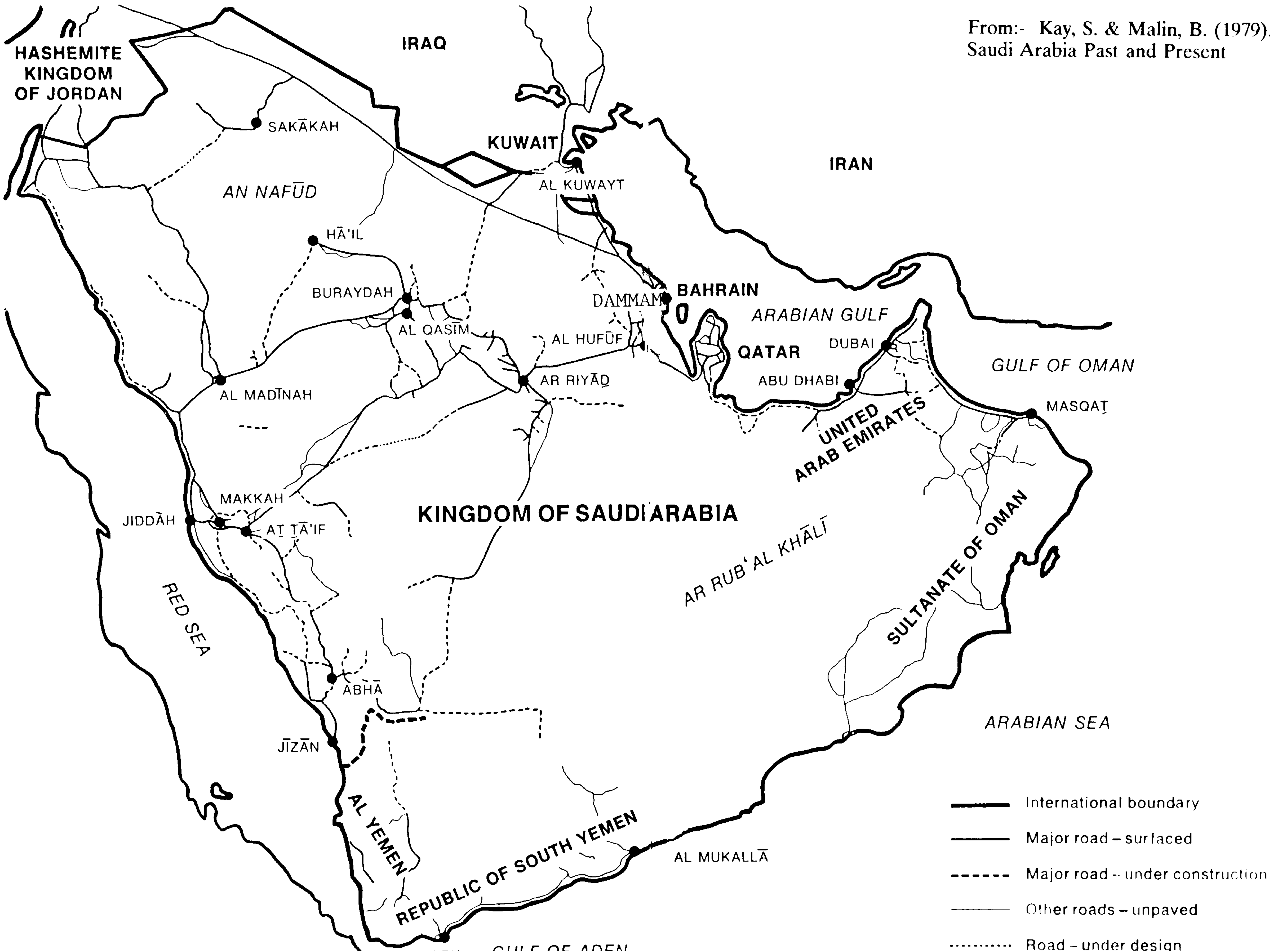

Table 1.1

The population distribution in Saudi Arabia (1975)

Location	No. of people	% of the total population
Urban	3,564,251	51.36
Rural (villages)	1,864,926	26.87
Nomads	1,510,464	21.77
TOTAL	6,939,641*	100.00

* Not including those who were abroad at the time of the census.

The crude birth rate at 42 is significantly higher than that of the U.K., but similar to other countries in the region (UNICEF, 1989). These countries share high annual population growth rates despite also having high infant mortality and under-5 mortality rate (see Table 1.2).

Table 1.2

Comparative birth and mortality statistics

Country	Crude birth rate	I.M.R.	U5MR	% population annual growth rate
Saudi Arabia	42	72	102	4.1
Kuwait	33	19	23	4.4
Oman	46	109	172	4.7
U.K.	11	9	13	0.1

There is considerable regional variation within Saudi Arabia in infant mortality rate and the IMR in Asir (an agricultural oasis) and among the nomads has been estimated to be between 60-70% (Ohlsson, 1985). A high death rate of women in childbirth is also reported to occur.

More than half of the population is under the age of 20 years. Results of a survey carried out in 1975 by the Central Department of Statistics, showing the age/sex distribution of the population are shown in Table 1.3.

Table 1.3

The age/sex distribution of the Saudi population in 1975

Age (yrs)	% of the total population	Proportion % Male	Proportion % Female
Less than 5	16.5	50.3	49.7
5-14	27.3	50.8	49.2
15-24	20.2	54.3	45.7
25-34	12.0	55.8	44.2
35-44	9.4	51.2	48.8
45-54	6.9	52.1	47.9
55-59	3.2	51.8	49.2
60+	4.5	52.4	47.6
AVERAGE	100.0	52.3	47.7

It can be seen that almost 44% of the population are aged 14 or under, the largest population group being 5-14 years old. It can therefore be anticipated that the population is likely to increase rapidly in the next ten years as this group reaches childbearing age. With advancing age there is also a change in the male/female ratio, in favour of the males. The life expectancy at birth in 1987 is 64 years (UNICEF, 1989).

The Saudi population is relatively homogenous ethnically. Non-Saudi Arabs are concentrated in the Holy cities of Mecca, Medina and Jeddah, generally having settled there after pilgrimages. Yemeni refugees entered Asir in large numbers in 1962. The population of the Eastern Arabian cities is also largely foreign as a result of importation of non-Saudi technicians, although the need for them is diminishing as locals are being trained.

1.3. Social Organization

The family is the centre of the social structure, and loyalty to the family overshadows all other obligations. Individual members participate in major family matters, but the final decision lies in the hands of the father or the head of the family. Women are rarely consulted in the decision-making process.

The basic family is an extended one, with descent traced through the paternal line. An individual's well-being is the responsibility of the whole family, and the well-being of the family is the primary concern of the individual. If the head of a household dies his family is absorbed into the larger family group. The older children of the deceased usually join the family of the paternal grandfather, or that of the eldest surviving brother. The widow may stay with the husband's family, or return to her own family, in which case she may take the youngest children with her. Although the mother's family has the responsibility of the upbringing of the widow's youngest children, they must return to their father's family between the ages of six and ten. The final responsibility for the individual members of the family does not necessarily rest with the patriarch. It is not unusual for a more distant relative to take in members of a family. A bachelor, or a man with a small family, may take on the responsibility for needy family members, such as a cousin and his or her children.

Women lead extremely private lives, subject entirely to the will of the men in the family. When a woman appears in public she must wear a long black cloak (abaia), covering her from head to toe, and hide her face behind a veil.

Marriages in towns and villages are arranged by the family. When a man is ready to marry, he makes his intentions known to his family, and the father (or any other close male relative) will then inquire among the fathers of eligible daughters. Once a bride has been chosen, the future husband may send his mother or sister (or a relative) for their opinion of his prospective wife. The bride or groom ordinarily meet each other for the first time on their wedding day, during the marriage ceremony. Some of the more modern, educated young people are breaking with these traditions and are choosing their own partner.

The marriage system of the Bedouins varies from the general system. Since nomadic women are less restricted in their social contacts, it is not uncommon for a young couple to have met and talked to each other prior to the making of the marriage contract. As a consequence there are relatively more love matches amongst the Bedouins than the settled people. The relative freedom of the individual to choose a partner also implies relative freedom to terminate an unsatisfactory relationship.

The Quran permits a man to have four wives, but it stipulates that all have to be treated equally. Hence most Saudi Arabians have only one wife. A man can divorce any of his four wives relatively easily, but not without certain obligations, such as providing for the children. Although the Quran has many reference to the rights and fair treatment of women, their position in all the traditional Arab societies is inferior (Walpole *et al.*, 1971; Sebai, 1981).

Men and women rarely socialise together, and when families gather, the women keep to themselves. In the past, Saudi women had been insulated from the social life of the country. Only in recent years have women begun to participate in some social and charitable activities (Al-Yom, 1986).

The social standing of a man is very important in the Saudi community. It is determined by his family and the tribe or region from which he originates. There are three classes in the nation; the highest social standing is accorded to wealthy merchants who have achieved the life-style of the upper class. The lower class consists of Bedouin and herdsmen and semi-skilled and unskilled workers, employed in the government and private sectors. A middle class is slowly emerging, its growth associated with the transformation of the nation from a traditional economy based on the exploitation of oil and the expanding role of the government. This new economy requires trained managers, engineers and technicians. The growing middle class is stratified into upper and lower divisions. The upper stratum consists largely of engineers, accountants, physicians, college teachers, high level government officials and some businessmen. The lower stratum consists of skilled blue-collar workers, primary school teachers and lower grade government clerks. Thus the prestige attached to a job is very important. In the choice of an occupation, a man will accept lower wages for a given job if it is considered more prestigious (Knauerhase, 1975; Al-Shwaiby, 1976).

1.4. Standard of Living

The GNP *per capita* in 1986 was estimated at £4,633. This represents a substantial decline since the late 1970s and reflects changes in the world's oil economy. The government, anxious to raise living standards, initiated an ambitious programme of activities at that time aimed at improving housing conditions, the quality of water supplies, education and the standard of health, which produced encouraging results (see Appendix I). More recently, these activities have been subject to cut-backs in response to the altered financial climate.

In addition, the standard of living of the majority of Saudis is still determined by geographical circumstances and traditional cultural patterns. The highest standards of living are in the oil-rich Eastern Province, Riyadh and Hijaz.

Refinements such as electricity, refrigeration and sanitary facilities are rare in the villages and deserts and are limited to the most developed areas of the country. Rapid urban growth has created an acute housing shortage in major cities. In the cities people live in villas, apartments or houses, generally constructed from cement, concrete blocks or bricks, and laid out in regular arrangements. The larger more substantial homes belong to the wealthy. Many houses are surrounded by walls which also enclose a small garden and a courtyard (Walpole *et al.*, 1971).

The typical village is a cluster of flat-roofed, simple houses of mud brick or stone, close to gardens or fields. Frequently domestic animals are given shelter in a room adjacent to the living quarters. House furnishings comprise little more than a few mats, chests and cooking equipment. Electricity, air conditioning and sewage facilities are a luxury to the people of cities and some villages. In recent years the government has tried hard to spread development to the rest of the villages.

The housing conditions of the Bedouins are mostly sub-standard, both in quality and quantity. Most of them live in tents made of camel hair or sheep wool, or shacks or huts. Their life and economy have the following characteristics:

1. Low *per capita* income compared with the national average;
2. Heavy reliance on raising livestock as their basic source of income, whilst producing the major part of domestic meat supplies;
3. Almost total dependence on the weather conditions for the survival of their flocks and herds;

4. A rapidly deteriorating range of lands in most areas, due largely to over-grazing;
5. A lack of immediate access to most social, educational and other services;
6. The significant migration to urban areas resulting in an estimated net annual decrease of 2% in the nomadic population.

The Bedouins have a complex and highly developed social, economic and legal system, that has adapted to change over many hundreds of years. Nevertheless, the pace of change in the rest of the kingdom has recently been so fast that the economic and social gap between the Bedouins and the remainder of the population is widening. Education, health standards, housing and wage labour activities remain much the same, except in the field of transportation (Saadeddin *et al.*, 1978). Details of the economy are found in Appendix I.

1.5. <u>Social Trends</u>

The economic changes of the past few decades have caused some changes for the family system. With more money to spend, Saudi Arabs have been able to travel and study abroad. These travellers have come into contact with ways of life sometimes differing greatly from their own. The government recognizes that changes in the status of women are occurring and finds it desirable that women be able not only to understand the world outside the home, but also to participate in it. Since 1960, the number of schools, institutes, colleges and social clubs for women has increased in leading cities (Walpole *et al.*, 1971). A high number of women and girls are attending schools and colleges and getting out of the house more frequently. Details of education are found in Appendix I.

Urbanization

Due to the shortage of water and the use of primitive agricultural techniques, in the past few decades, Saudi agriculture is very unproductive in some rural areas and consequently rural income is very low. On the other hand, oil income has created a big opportunity for workers in urban areas. In 1980 the average annual income in the agricultural sector was £1,300 per worker, whilst in non-agricultural activities (other than oil), the average annual income was £10,000 per worker; almost eight times greater. The large gap between urban and rural income has created a massive flow of the rural population into the cities. Another cause of the high urban drift has been due to the increased supply of social services, provided by the government in the urban areas. The educational opportunities available in the cities has been a major force attracting the young rural Saudis to large metropolitan centres (Al-Yom, 1988).

1.6. Lifestyle, Nutrition and Food Habits

Daily Rounds of Activity

In the typical household the day begins with the first call to prayer just before dawn. Afterwards, the family eats a light breakfast and then the men depart for their work. In the town, the day may begin somewhat later.

Older sons, if not employed elsewhere, usually work with their father. Where there are schools the families may send some of their children from morning to early afternoon. At home, the women and the servants (if they have any) will put the house in order and prepare the lunch-time meal.

The largest meal of the day is taken in the early afternoon in the urban areas, but amongst the nomads it is served in the evening. Unlike villagers and townsmen, Bedouin men do not return home at midday. Dinner is a family affair, unless there are guests who are not close relatives; in such cases the men will be served apart from the women and children (Walpole *et al.*, 1971).

In the afternoon, women frequently visit friends and neighbours. When not visiting they are likely to use the time in sewing, cooking or watching television, and amongst the Bedouins, weaving. In the towns, during the latter part of the afternoon, Saudi men gather with their friends at cafés to drink coffee or tea and to discuss the current affairs. These sessions may last until the evening. Early evening is also a visiting period for men, and during most of the year is the principaltime for neighbouring Bedouin men to gather for discussion. Younger men in the cities often entertain each other with a light supper in their homes and then spend the evening listening to the radio, playing cards, watching television or videos or chatting. The women are not allowed to leave the home alone after dark (Arab News, 1987).

Traditional problems, such as food shortages and transportation, have been greatly eased with the aid of the Saudi government. The produce grown reaches local and distant markets and the country has become less reliant on imports for its food needs. The Saudi diet has improved since 1975 both in quantity and quality. According to a survey carried out in 1975, the average daily Saudi diet contained about 1,800 cals, 51.3 gms of protein and 32.6 gms of fat. By 1984, the average daily diet had increased to 3,265 cals, including 88.3 gms of protein and 90.2 gms of fat. In 1984, consumption of animal products also increased, providing about 17% of the total energy and about 42.5% of the total protein. However fat still only provided 25% of total energy. Food group consumption had also changed from 1975 to 1984, as shown in Table 1.4 (MAAW, 1984).

Table 1.4

Changing Patterns of Consumption by Food Groups in 1975 and 1984

Foods	Consumption (kg) 1975	1984	% Increase
Cereals	94.4	131.9	40.0
Fresh vegetables	56.9	80.7	42.0
Fresh fruits	97.8	143.3	46.0
Red meat	10.8	19.3	79.0
Chicken meat	7.6	26.1	243.0
Fresh fish	2.7	6.0	126.0
Eggs	2.5	8.6	244.0
Fresh milk	29.2	38.1	31.0
Oils and fats	4.0	15.1	278.0

A change in technology has helped to change the food consumption pattern of Saudi households, especially the upper and middle classes. Comfortable and efficient housing, more electric appliances, such as refrigerators and mixers, the use of pressure cookers, new food products and the development of food stores, especially supermarkets, have contributed to these changes.

The introduction of new food products in Saudi Arabia has resulted in major changes in food consumption patterns, such as the use of frozen or canned vegetables and fruit such as strawberries and kiwi, pizzas, burgers, fried chicken and many different kinds of ice cream. Such convenience foods are eaten by foreigners, students and by those who have travelled abroad before, as well as by Saudis out of curiosity.

The diet in different parts of Saudi Arabia is varied. The townsmen have a more varied menu than the country dwellers. In the past, the towns have been dependent on the countryside for food, but imported foods are now available in the larger towns and coastal sea ports.

However, even in the country there is a difference in the diet between the Bedouins and the settled cultivators. The diet of nomads is lower in total calorie intake and consists mainly of flat bread made from flour. The diet is varied including milk and milk products from goats, sheep or camels; together with dates, rice or less frequently wheat. Milk is drunk fresh or curdled into yoghurt or cheese. Coffee and tea are the favourite beverages. Meat is eaten only on special occasions, when available, and locusts are also consumed. Nomads eat fresh fruit and vegetables only when they visit the villages of settled cultivators. Despite his meagre diet, the average Bedouin generally has considerable physical endurance. In nomadic families the husband and adult sons are generally better fed than the women and children, who eat the left-overs after the men have finished their meal. Little food is eaten during the day and the main meal is in the evening (Walpole *et al.*, 1971).

Although the diet of the average cultivator is more substantial than that of the nomad, it contains less protein and fat. The staple food of this group is millet, supplemented by rice, barley and wheat, when they are obtainable. These cereals are cooked into a gruel, and wheat and barley are made into bread. Fruits, especially dates and vegetables, are eaten regularly; meat only occasionally. Although goats and camels are eaten, the main source of meat is sheep. Cattle are not numerous and are used mainly as beasts of burden. The consumption of pork is forbidden to Moslems, and the slaughter of other animals is governed by Islamic laws. Fish is becoming more available, but is not widely eaten (Walpole *et al.*, 1971; Arab News, 1987).

The daily meal pattern for urban dwellers consists of two simple meals (breakfast and dinner), one cooked meal (lunch) and sometimes snacks in between. The main energy source at lunch is usually wheat or rice and some type of meat or fish. Small amounts of vegetables (eggplants, potatoes, okra, zucchini and tomatoes) are consumed, either cooked with a tomato sauce (as Maraq) or as salads, with lettuce, cucumber and tomatoes. Tea and coffee, or other beverages, sweets, sandwiches and fruits can be consumed with meals as snacks. Some families do not save left-over food to be used the next day, although most urban houses have at least one refrigerator. It is clear that bread is universally consumed and is usually eaten once or more times a day by Saudi families. Bread is eaten mainly during breakfast and dinner.

Red meat is eaten more frequently than fish or poultry, with mutton and lamb preferred over beef, which is rarely consumed except in the form of burgers or sausages. Meat is consumed regularly. The usual method of cooking meat is to mix it with rice and a lot of spices, or to cook it with vegetables and tomatoes as a stew. Frozen meat is not purchased for the reasons that fresh meat is considered to have more taste and has better nutritive value, however meat is preserved in the frozen state at home. This discrepancy can be explained by religious ideas, since imported animals may not have been slaughtered following the Islamic rules.

Chicken is the main type of poultry consumed, normally once or twice a week. Frying or broiling the chicken after boiling is one of the common methods of cooking. The rice may then be cooked in the same water used to boil the chicken. Mixing the chicken with the rice is another method preferred by some people.

Fish is also consumed. One of the commonest ways of cooking fish is by frying it in oil after seasoning. Fish is also cooked with rice and spices.

Saudi families drink milk alone or mixed with tea at breakfast and dinner. Milk products such as cheese, yoghurt and labnah are consumed during breakfast and/or dinner. Eggs are preferred boiled at breakfast, or made with tomatoes and onions (shakshoka).

The preferred legumes are lentils and beans, but only consumed irregularly. Chick peas are also consumed, boiled with salt or made as an appetizer (humus).

Nuts and seeds are also consumed in large quantities and are used in the preparation of many varieties of Arabic and Saudi sweets. The most common varieties are almonds, pistachios, peanuts and water melon and pumpkin seeds.

Besides dates, Saudis consume different kinds of fresh fruits such as apples, oranges, melons, bananas and water melons, especially with meals when they are often offered to visitors.

Fat and oil are used in the preparation of many dishes (2.7 kg consumed per person in 1971). Vegetable oils are used for frying and cooking (principally imported corn oil), while the use of traditional animal fats such as "semeneh" (from sheep fat) and zipda (butter) which are used in cooking traditional foods and sweets is becoming less common.

The hot climate in Saudi Arabia encourages people to drink different kinds of beverages. Sweet tea and coffee are popular drinks. In 1978, the consumption of tea was 1579 gms *per capita* and in 1980 the total consumption was 12,810 tonnes (Moliver and Abbondante, 1980; UN, 1981). The consumption of coffee is not known, it is usually mixed with cardamon and saffron without sugar. Alcoholic beverages are forbidden in Saudi Arabia by Islamic laws. Carbonated beverages are consumed more often than fruit juices.

Seasoning is used in all Saudi dishes. Common spices used are black and red pepper, curry powder, mixed spices, saffron, cardamon, cinnamon and garlic. Salt is also used extensively for seasoning.

Saudi families feel comfortable eating together and prefer sitting on the floor, which is a Bedouin habit, although some prefer to sit at the table (Western style).

Traditionally, food is served on a big tray around which the family members gather, or served on a piece of cloth or plastic, eating the food with their fingers from the same dish. Modern and educated people sit around the table and eat from individual plates, using spoons rather than forks or knives. However, eating with the fingers is still prevalent.

1.7. Religion

The Saudi Arabian people inherited a culture strongly influenced by religion of Islamic Law originating from the Holy Quran, with the Prophet Muhammad's (PBUH) teaching forming the basis of the constitution of the Kingdom, as well as the civil and criminal penal codes.

Islam also guides the Saudis in their daily life, governing morals, eating and dress habits, business dealings and the Hijra Calendar. All Saudis adhere to the Islamic faith (ISADC, 1977).

Food rules that govern Saudi food habits are affected by Islam and these will be discussed in detail, with special reference to pregnancy, in Chapter IV.

1.8. Health in Saudi Arabia

Sanitation and Water Supply

Despite an expansion of sewage facilities, poor sanitation is still a major cause of disease. Outside the cities, surface drainage is the most common method of sewage disposal. Drainage ditches carry the sewage to the outskirts of the areas, where it is evaporated by the heat. Waste may filter through drainage channels into the source of the water supply. Nomads, villagers and the poorer townspeople use open-air latrines, which become the breeding ground for disease. Few houses have cisterns or other waste disposal facilities in these areas (Walpole *et al.*, 1971).

The scarcity of clean water also contributes to the incidence of disease. In the villages water is generally available from springs or public wells. In some urban areas water is conveyed by surface or underground channels or by canals from springs and wells to centrally located tanks from which the inhabitants of the towns can draw their water. In many localities the water supply is contaminated by human or animal waste. Piped water systems have spread to most main cities in Saudi Arabia. The water comes from more than twenty distillation stations existing near the western and eastern coasts. The total production of each unit is 60,000 gallons of water each day.

Incidence and Treatment of Disease

The incidence of disease is related to widespread malnutrition (under-nutrition and over-nutrition), crowded living conditions, a general lack of pure water supplies in some areas, improper sanitation and ignorance regarding personal cleanliness. Illness was traditionally regarded as a manifestation of God's will or the work of evil spirits (Sebai, 1984).

City and townsmen are apt to be better informed about the relation of germs and disease and about modern methods of treatment than the nomads and villagers, who are more fatalistic about sickness. Their faith in modern medicine is becoming more widespread as medical facilities become more available and their efficiency is demonstrated. Health facilities and vaccination programmes are most effective in the urban areas, although since the 1960s the government has been concentrating on eradication programmes in Asir and amongst the nomads. Pneumonia, tuberculosis, trachoma, enteric diseases, malaria and parasitic diseases are the major problems. Mortality statistics and data on which to base estimates of the incidence of disease are lacking. Malaria is now limited to the valleys of Asir, the Tihama region, the irrigated areas of the Eastern Province and the Qatif. Enteric diseases occur throughout the country. Diarrhoea and enteritis are widespread amongst infants and are believed to be responsible for half of the infant mortality. Parasitic diseases account for the major debilitating maladies, affecting as much as 50% of the population in 1971 (Walpole *et al.*, 1971). Now Bilharziasis is present in the oases scattered in the desert and Saudi Arabia is surrounded by endemic areas of Bilharziasis, like Iraq, Egypt and Yemen. In the Mecca region these diseases could be transferred by pilgrims coming from endemic areas of Bilharziasis (Saudi Medical Magazine, 1983).

Other nutrition-related disease that occur in Saudi Arabia include:

(a) Diabetes

A high incidence of *Diabetes mellitus* exists compared with figures for African communities and Western countries. In a study carried out by Riyadh University, 1,300 people had been examined from 11 villages in a community 200 miles north of the capital. The prevalence rate was found to be 4.5%, compared with about 0.5% in the West. Another survey was carried out amongst the patients of the diabetic clinic in the capital. Out of 200 patients examined, 70% were found to be over 40 years of age and a similar proportion also were overweight. Ocular complications featured prominently in 56% of the patients (Vok, 1980).

(b) Vitamin Deficiencies

Sedrani investigated the status of vitamin D in 175 people living in Riyadh for more than two years. He found that more than 53% of the sample had low serum 25-hydroxy vitamin D concentration (Sedrani, 1984). In another study, Sedrani *et al.* found that the average dietary intake of vitamin D of Saudis was 55 IU/day, which is about one-seventh of the RDA in the United States. The study also showed that dihydroxylated vitamin D metabolite levels were normal in the male university students, but deficient in elderly people. The authors suggested that low vitamin D_3 status in the elderly was due to avoidance of sunlight, a low dietary intake of vitamin D and dust particles which absorb the ultra-violet light. The clothing styles of the Saudi people were excluded as a cause for vitamin D deficiency, since adequate serum vitamin D levels (25-OH-D_3) were found in the female students who covered themselves completely (Sedrani *et al.*, 1983).

Vitamin D deficiency rickets was reported by Elidrissy and Taha in 1981. They found 31 cases (aged 2-24 months) from low socio-economic status families, who were admitted to the Riyadh Maternity and Children's Hospital over a period of 14 months. They attributed these findings to the low exposure of the infants to sunlight due to over-dressing, keeping them indoors and continuing breast feeding for a long time without vitamin supplements (Elidrissy and Taha, 1981). Elidrissy *et al.* also found, after studying 74 rachitic and non-rachitic children, that in the first 6 months of life, the vitamin D content in breast milk was insufficient to prevent rickets. Therefore, supplementary vitamin D and increased exposure to sunlight are recommended for infants (Elidrissy *et al.*, 1982).

Health Facilities

Health and medical facilities are available to all citizens and residents of the kingdom free of charge. In recent years, these services have greatly expanded; existing hospitals have been modernized, new hospitals and health clinics constructed and the number of health personnel increased. The following table shows the development in the medical services (CDS, 1985).

TABLE 1.5

Development in the Medical Services (from 1980 to 1985)

Medical Services	**1980/81**	**1984-85**	**% Increase**
	(£ million)	**(£ million)**	
Govt appropriation for health	1301	1826	40
	(No.)	**(No.)**	
Government hospitals	70	86	23
Private hospitals	26	31	19
Number of beds	13066	20796	59
Av. No. beds/1000 population	1.5	2	33
No. of Health Centres	935	1306	40
No. of Physicians	5585	9966	78
No. of Nurses	11599	19641	69

According to the 1987 estimates, there is one doctor for every 4715 members of the population, compared with one per 5029 members of the population in 1978. In addition, there are now 1233 pharmacies in the Kingdom.

The Health Status of Pregnant and Lactating Women and Infants in Saudi Arabia

The health status of mothers and their children is indicated by measurements of morbidity, mortality and growth and development. In many developing countries data on mortality and morbidity are scarce. The birth weight is also considered an important indicator, reflecting both the past and present health status of the mother, as well as predicting the future health of the infant.

There is very little information available on the health status of Saudi women. The prevalence of anaemia in the obstetric patients of 1.0% to 2.6% is low. The levels of 25-hydroxy vitamin D in maternal and cord blood are very low. The levels are lower in the low social classes and correlated with living in houses without exposure to the sun (Ohlsson, 1985).

The genes for sickle cell disease and thalassaemia are common in certain portions of the Saudi population, mainly amongst the Shiite segment. The incidence of abortion, congenital abnormalities, premature spontaneous deliveries, perinatal deaths, toxaemia and infections, are higher amongst pregnant Saudi females with sickle cell anaemia than amongst normal pregnant women.

The figures for maternal mortality in Saudi Arabia are high compared to developed countries. In the Maternity and Children's Hospital in Riyadh, the maternal mortality was 52 per 100,000 births during the years 1978 to 1980, when births totalled 55,428. Haemorrhage, associated diseases, pulmonary embolism and infection were the main causes of maternal death. In addition, social causes (high parity and close birth interval, pregnancies at the extremes of the reproductive age range, poverty, illiteracy, cultural practices and beliefs, lack of maternity services, shortage of health workers, delivery by untrained dais, poor environmental sanitation and poor transport facilities), could lead to maternal mortality in developing countries. Pregnancy in adolescence constitutes a high risk of obstetric situation. In Saudi Arabia adolescents have an increased incidence of premature delivery, low birth weight infants, fetal malpresentations and operative delivery (Ohlsson, 1985).

In developed countries about 15% of all pregnancies can be defined antenatally as a risk. The incidence of high risk pregnancies is higher in Saudi Arabia, about 25% in the south-western region and 54.4% in the Eastern Province. Studies have also shown that in developing countries mortality is high in the first pregnancy and lower in the second and third pregnancies. It begins to rise again after the fourth pregnancy, reaching high levels after the fifth. Multi parity plays an important role in maternal mortality. Most Saudi mothers do not receive adequate antenatal care, even in the big cities. Only 40% of the mothers who gave birth at the Maternity and Children's Hospital in Riyadh during 1978-80 received adequate antenatal care. Forty-nine percent of the parents were seen for the first time when in labour at the King Faisal Military Hospital in Khamis Mushayt and 30% at the Maternity and Children's Hospital (Ohlsson, 1985). In rural areas less than 18% of the mothers giving birth have antenatal care, as around 89% of births still take place at home (Sebai and Shalaby, 1982), compared with only 30% in the capital city of Riyadh (Chattopadhyay *et al.*, 1983). In rural areas the delivery is carried out by mothers, grandmothers, old women and nurse-midwives, as well as in hospitals.

For the infant health status, the perinatal mortality rate is dependent on parity, the age of the mother, the birth order and gestational age. The lowest perinatal mortality rate exists in the group of mothers between the ages of 20 to 29 years. The PMR and IMR are also linked to the socio-economic status. Characteristics of the maternal population in Saudi Arabia predispose towards a high PMR, because many mothers belong to a low socio-economic group, are younger than 20 or older than 29 years of age and are grand multiparas. The low birth weight in Saudi Arabia was reported as 5% at the Military Hospital in Riyadh (1978-79), 5.5% at the Military Hospital in Khamis Mushayt (1978-79) and 7.7% at the King Faisal Specialist Hospital in Riyadh (1976-81). The PMR for Saudi Arabia is estimated to be 30-40 per 1000 births (Ohlsson, 1985). At the Dharhan Health Centre (November 1981 to January 1982), major congenital malformations were reported in 1% of 3,058 live births and 17 of 54 stillbirths; thus congenital malformations were a major cause of perinatal deaths (Thalj *et al.*, 1982).

The incidence of sepsis amongst neonates born at the KFSH is 2 per 1000 live births. Mortality associated with neonatal sepsis is high in Saudi Arabia, at 45% in 1976, dropping to 31% in 1980 at the same hospital. The reasons for the high mortality were associated severe malformations and late referrals (Thalj *et al.*, 1982).

At the Maternity and Children's Hospital in the capital, 22.4% of the 214 neonates admitted from home with infections subsequently died during February 1980 to March 1981. The highest mortality was amongst the low birth weight group, preterms and light-for-date infants. The neonates tended to be from a low socio-economic class and were either bottle fed or mixed fed. Most of their mothers were illiterate, and sought medical advice at a late stage of the infant's sickness. About 31% of the infants had been cauterized (burnt) (Elrifai, 1982). Delay in seeking medical advice for sick infants was a major cause of death amongst neonates in Al-Khabar (Akhnoukh, 1979). Infant mortality in Saudi Arabia varies from 15.6 to 144 per 1000 live births in different areas, as shown in the following table.

Table 1.6

Comparative IMR at Different Regions in Saudi Arabia

Area	IMR	Reference
Barza (1979)	40	Akhnoukh, 1979
Desert Central Region (1978-79)	117	Serenius & Fougerause, 1981
Tamnia (1978-79)	144	" " "
Tihama (1978-79)	133	" " "
Al-Qseem (1982)	52	Sebai & Shalaby, 1982
Aramco and Dhahran (1982)	15.6	PMSD, 1983

In Saudi Arabia, conditions originating in the perinatal period, congenital malformations and infectious diseases are the main causes of infant mortality (Ohlsson, 1985).

1.9. Summary

Despite increasing affluence and improvements in the provision of education and antenatal care in Saudi Arabia, the statistics concerning maternal health and infant mortality indicate continuing problems. These may in part be related to eating habits and nutrition during pregnancy and the puerperium, together with infant feeding practices. Consequently these areas form the subject of a series of studies which were undertaken in Saudi Arabia intended to provide data which was previously unavailable. All studies were carried out in Dammam, a modern city and capital of the Eastern Region. The population was estimated at 127,844 in 1987 (TEYB, 1987). In the past its inhabitants were largely engaged in pearl fishing, trade and date production. However its economic base is now dominated by the oil industry and it is the second largest port in Saudi Arabia.

CHAPTER II

FACTORS INFLUENCING BIRTH WEIGHT IN SAUDI ARABIA

2.1. Introduction

The most important factor associated with high perinatal, neonatal and infant mortality rates in developing countries is the high percentage of babies with low birth weight. It has been estimated that approximately 19 million LBW babies were born in developing countries in 1979 and the majority of them were small for date, but not premature, as more commonly found in the developed countries (WHO, 1973; Belizan *et al.*, 1978; WHO, 1980). It is believed that other factors are more important in determining fetal growth than genetic influences (Polani, 1974).

Many factors have been considered to influence fetal nutrition and growth which may be categorized as biological and environmental determinants. Some factors are inter-linked, for example age and parity, which are also a reflection of the mother's cultural environment. The determination of the relative importance of any factor is always complicated. Some factors can affect fetal growth directly, such as diet during pregnancy, whereas others influence indirectly, such as the mother's age, parity and illness (Habicht *et al.*, 1973).

The factors which are considered to play an important role in determining birth weight will now be reviewed briefly and consideration given to their potential importance in the Saudi Arabian context.

2.2. Biological and Environmental Determinants

2.2.1. Biological Determinants

(a) Age

Maternal age plays an important role in the determination of the outcome of pregnancy. Age by itself can influence fetal growth when pregnancy occurs during the adolescent period. Results of many studies show that babies born to adolescent mothers are significantly smaller than babies born to mature mothers (Naeye, 1981a; Frisancho *et al.*, 1983,1984). In developing countries, marriages occur around the age of menarche and therefore child-bearing also occurs at an early age. It is generally agreed that the risk of having low birth weight babies is doubled when pregnancy occurs within two years of menarche (Ebrahim, 1983). Several factors may play a role in this respect, competition for energy and nutrients between young mother and fetus, and placental insufficiency in an immature woman (Weigly, 1975; Heald and Jacobson, 1980; Marino and King, 1980).

In Bahrain the incidence of low birth weight was observed to be 11% of 15-19 year age group, compared to 7% in the 20-39 year age group and 6.8 in those older than 39 years of age (Musaiger, 1985).

Marriage age in Saudi Arabia occurs at average of 16 years and first pregnancy occurs as soon as possible (Sebai, 1984). Since early marriage and early pregnancy are commonly practised in Saudi Arabia, these factors may be of importance in determining the rates of LBW.

(b) **Parity**

The primipara is considered at risk of producing low birth weight babies, particularly when she is young. However, the risk of the grand multipara is even greater and in many developing countries 40% of mothers have high parity (4 or more). Results of many studies show that the second baby is usually heavier than the first baby (Hytten and Leitch, 1971; Eveleth and Tanner, 1976; Reinhardt, 1980; Dougherty and Jones, 1982). Thereafter, birth weight may depend on the birth interval between pregnancies and the depletion of maternal nutritional stores. In Iraq and Nigeria a consistent increase in the birth weight up to the fourth child, before a decline, has been reported by Ramankutty *et al.* (1983) and Rehan and Tafida (1979). While in India it has been shown that parity has a negative effect on birth weight (Rajalakshmi, 1980).

Parity is closely related to age, which reflects the physical effects of previous gestational experience (NAC, 1970). The relative influence of age and parity on birth weight of Iraqi children was examined by regression analysis, keeping one of the variables constant. It showed that up to the age of 29 years there was a significant relationship between parity (up to 4) and birth weight. However, there was no such consistent relationship between birth weight and parity when the mother's age was kept constant (Ramakutty *et al.*, 1983).

The decline in birth weight after the fourth child was possibly due to the adverse impact of repeated pregnancies and childbirth on the state of health and nutrition of the mother.

Large families (>7) are still common in Saudi Arabia (Sebai, 1984). Religion, culture and tradition support having a big family, which is a source of support and comfort to its members and also ensures that the family name is carried on.

(c) **Height**

One of the factors associated with low birth weight in low income groups is short maternal stature (Ebrahim, 1983). Ba'aqeel *et al.* (1989) and Magahed (1986) found that mothers from low socio-economic strata with a height of less than 150 cm gave birth to babies with a low average birth weight. Stunting in a mother cannot be overcome by a good diet during pregnancy. This emphasises the need for good nutrition and health care in childhood, so that women enter motherhood having achieved optimum growth and health. Results from perinatal studies in the U.K. in 1958 and 1970 revealed that there were more short mothers in the lower socio-economic groups, showing that inadequate nutrition and more illness prevented many girls in this group from achieving their optimal physique (Ebrahim, 1983).

A linear relationship between maternal height and birth weight has also been noted in other studies in developing (Dam, 1966; Mukherjee and Sethna, 1970; Mbise and Boersma, 1979) and developed countries (Hytten and Leitch, 1964).

No data is available concerning heights of Saudi Arabian women in Dammam on which any assessment of this factor can be made.

(d) **Pre-pregnant weight and weight gain**

Maternal weight gain is accounted for by the fetus, the placenta and the woman's compensatory changes for pregnancy and subsequent lactation. The issue of optimum weight gain is controversial. The Committee on Nutrition of the American College of Obstetricians and Gynaecologists recommends 10-12 kg. The incidence of pregnancy complications seems to be the lowest and the outcome the best at these values.

The relationship between the maternal weight gain and the birth weight of the infant is still an unresolved question (NAC, 1970; Beal, 1971; Thomson and Hytten, 1973). A large number of studies report a positive correlation between the maternal gain and the birth weight of the baby (Miller and Hassanein, 1973; Winick *et al.*, 1973). In some studies, the mother's pre-pregnant weight and height are associated more closely with birth weight of the infant, rather than maternal weight gain (Ademowore *et al.*, 1972; Hillman and Goodhart, 1973).

Other studies have shown that both the maternal weight gain and the mother's pre-pregnant weight are the two strongest influences on the birth weight (Beal, 1971; Naeye *et al.*, 1973; Munro, 1974). The importance of pre-pregnancy weight and maternal weight gain were shown in a study carried out by the National Institutes of Health in the U.S. (Ebrahim, 1983). Mothers who weighed more than 68 kg at conception or those who gained more than 13.6 kg in weight during pregnancy tended to give birth to larger and healthier babies, with a lower perinatal mortality, compared with mothers who weighed less or gained less weight during their pregnancy.

There is at present no data available on non-pregnant weights of Saudi Arabian women in Dammam, or on weight gains during pregnancy. However, a study in Riyadh showed that neither low weight gain mothers (<6 kg) nor high weight gain mothers (>12 kg) were significantly more likely to have LBW babies (Ba'aqeel *et al.*, 1989).

2.2.2. Environmental Determinants

(a) **Birth interval**

Many studies have reported that a very short interval between pregnancies is associated with adverse outcome of pregnancy (Mukherjee and Sethna, 1970; Fedrick and Adelstein, 1973). In Britain, the percentage of low birth weight babies who were born following an interval of 2-5 years was lower than those born in the shorter interval (Douglas, 1950).

In Bahrain, Musaiger (1985) has reported that the incidence of low birth weight was 8% for an interval of 9-12 months, decreasing to 6.1% for an interval of 13-24 months and to 5.9% for an interval of greater than 24 months. While in the poorer countries, the IMR for babies born within one year of a previous birth is usually between two to four times as high as for those born after an interval of two or more years.

Several researchers have found that the length of birth interval has a strong influence on pregnancy outcome (Mukherjee and Sethna, 1970; Fortney and Higgins, 1984). A birth interval of 12 months long or less was associated with 39% pregnancy wastage (miscarriage and stillbirths) of all pregnancies (2,407).

In practice, some women have neither the means nor the freedom to decide on the number or the frequency of births. No data has previously been published concerning average birth intervals in Dammam. However, Ba'aqeel *et al.* (1989) found that short or long interpregnancy interval was not associated with poor outcome.

(b) **Socio-economic status**

Social class has a marked influence on the size of the baby at birth. The babies of mothers from higher socio-economic groups being significantly heavier than those in lower socio-economic classes (Timmer, 1961; Naeye and Blane, 1970; Lechtig *et al.*, 1975; Edozien, 1980). Women of the poorer classes may not only suffer from chronic ill-health and under-nutrition, but also have to continue heavy work during their pregnancy. The average birth weights in the lower and higher classes were 2,950 g and 3,200 g respectively (Ebrahim, 1979).

The same picture was also reported by the Nutrition Unit in Kuwait, which showed significant differences in both birth weight and height of infants between low income group (160 mothers and children) who had a monthly income less than 300 Kuwaiti dinars (£600), and a high income group (150 mothers and children) who earned more than 300 Kuwaiti dinars per month. Infants weighing 2.5 kg or less constituted 2.2% of the high income and 3.9% of the low income group, whilst infants weighing 4.0 kg or more constituted 5.5% and 2.6% of the high and low income groups respectively. There was also a significant difference between the two groups in infant height. The average lengths of the infants from the low and high income groups were 47.59 cm and 48.36 cm respectively (Nutrition Unit, undated).

However, in Iraq family income and educational status of the mother had no influence on the infant birth weight (Ramankutty *et al.*, 1983). With increasing opportunities for female education it is possible that similar disparities between groups may occur in Saudi Arabia.

(c) **Antenatal care**

Availability of antenatal care has been shown to be related to birth weight in developing countries. In New Delhi, antenatal care for pregnant mothers was shown to have a significant effect on birth weight (Pachauri *et al.*, 1971)., while Ba'aqeel *et al.* (1989) found a significantly higher incidence of poor outcome in mothers from Riyadh who had no prenatal care. However, estimates indicate that only 20-25% of pregnant women attend antenatal care in the developing countries (Ebrahim, 1969). There are several reasons for such poor levels of antenatal care. The most important reasons are the lack of provision of facilities and the rural location of the population. Traditional customs may also play a part.

There has been a major hospital and health centre programme in Saudi Arabia and other programmes designed to improve the delivery of health care services. However, the figures concerning taking-up of antenatal care are not available for women in Dammam.

(d) **Smoking, alcohol and drug abuse**

Although cigarette smoking, abuse of alcohol and drugs have all been linked to low birth weight, these are unlikely to make a significant contribution to the problem in Saudi Arabia (Little, 1977; Naeye, 1981; Rudolph, 1981; Picone *et al.*, 1982).

(e) **Nutrient intake and pregnancy outcome**

There has been controversy concerning the relationship between maternal diet and fetal nutrition status. For a time the fetus was viewed as the perfect parasite. Evidence to the contrary comes by inference from the results from several sources: animal studies in which "dietary" restriction during pregnancy resulted in impaired fetal growth and development (Giroud, 1968; NAC, 1970). Retrospective studies of human populations subjected to severe food shortages during wars, epidemiological studies of pregnancy outcomes in poorly nourished communities, and studies designed to test the effects of nutrition supplementation on pregnant women (Adair, 1987).

The impact of dietary restrictions on birth weight has been demonstrated during famine, which happened in World War II (Antonov, 1947; Smith, 1947; Bergner and Susser, 1970; Stein *et al.*, 1975).

In Holland, mean birth weight of infants born before the famine was 3.338 kg, and then it declined to 3.000 kg after the famine. The phase of pregnancy during which food restriction occurred was an important factor. Famine conditions during the first trimester increased the incidence of prematurity, stillbirths and congenital abnormalities, while deprivations in the later trimesters resulted in a higher incidence of low birth weight. Similar conditions also prevailed during the seige of Leningrad from 1941 to 1943 (Antonov, 1947; Stein *et al.*, 1975; Stein and Susser, 1975). Similar findings have resulted from experiments performed on rats.

Food restriction in later pregnancy was also found to affect the fetus as judged by its birth weight (Morgan and Naismith, 1977).

Pregnant women in developing countries are nutritionally vulnerable. Available data indicated their diets provide a range of average daily energy intake between 1,100 and 2,060 kcal (Venkatachalam, 1962; Thanagkul and Amatayakul, 1975; Tafari *et al.*, 1980; Whitehead, 1988), whereas diets of pregnant women in developed countries provide a range of average daily energy intake of 2,100-2,700 kcal (Thomson, 1958; Beal, 1971; Durnin, 1980; Papoz *et al.*, 1981).

The proportion of energy derived from protein is about 10% in the normal diets of poor mothers, whereas it is 12% for rich mothers. In addition, protein quality of the diets in the former group is lower than that of the latter one (Srikardjati, 1985).

Little information is available on the effect of low vitamin and mineral intakes during pregnancy, except for iron deficiency (Garn *et al.*, 1981; Murphy *et al.*, 1986) and consequent anaemia.

(f) **Nutritional anaemia**

Anaemia is a major complication of pregnancy in developing countries. Several prevalence studies indicate that from 15-50% of pregnant women may have low haemoglobin (Demarchi *et al.*, 1966; Autret *et al.*, 1979; Al-Dallal, 1981; Amine, 1980; Musaiger and Sungpuag, 1985). Although many nutrients are involved in the production of red blood cells and haemoglobin, iron deficiency is the most common cause of nutritional anaemia in the world. Anaemia is considered present when the haemoglobin level is less than 11 g/dl and the haematocrit is less than 33% (WHO, 1968). Among the factors that lead to a high incidence of anaemia during pregnancy are infection, poor dietary intake, malabsorption and increased fetal demands. A significant difference in the mean haemoglobin concentrations before delivery was found between Iranian pregnant mothers from low and middle socio-economic status (Geissler *et al.*, 1978a). In the low socio-economic group, 33% of measured haemoglobin levels were below 10 g/dl, whereas in the middle socio-economic group only 3% were below 10 g/dl. In Saudi Arabia, only 5-6% of pregnant women in Asir and Jeddah were reported to have a haemoglobin level below 10 g/dl (Hartley, 1980; Smart *et al.*, 1983).

Deleterious effects of maternal anaemia on the outcome of pregnancy have been documented (Harrison and Ibeziako, 1973; Kaltreider and Johnson, 1976; Krause and Mahan, 1979). It is also associated with an increased risk of low birth weight and perinatal mortality. In East Africa it was found that amongst mothers who had a haemoglobin level of 7.4 g/percent or less at the time of delivery, the incidence of low birth weight was 42% and the stillbirth rate was 147.1 per 1,000.

In mothers with a haemoglobin level of 8.8 g/percent or more, the incidence of low birth weight was 51 per 1,000 (McGregor, 1963). A similar picture has been reported in Malaysia (Butler and Goldstein, 1973). It could be hypothesized that poor iron consumption leads to poor haemoglobin production, which in turn affects the delivery of oxygen to the uterus, placenta and developing fetus.

Therefore, iron supplements are prescribed for pregnant women who have a haemoglobin level less than 11 g/dl to restore the normal haemoglobin level and to replenish the depleted iron stores. The WHO (1972) recommended that 30-60 mg of iron per day should be taken by pregnant women. In Saudi Arabia, ferrous sulphate is given to pregnant mothers receiving hospital antenatal care, and usually administered as 300 mg tablets of the hydrated salt of ferrous sulphate, which provides 60 mg of iron.

2.3. Summary

From consideration of the literature it seemed probable that early and repeated pregnancies might make a significant contribution to the prevalence of LBW in Saudi Arabia. However, it was unclear to what extent this might be influenced by the provision of antenatal care and dietary practises during pregnancy. Consequently two studies were planned. Firstly to examine, from hospital records, the characteristics of mothers who gave birth to LBW babies in comparison with those whose babies weighed more than 2.5 kg. A second study, described in Chapter III, examined dietary practises and beliefs of a group of Saudi pregnant women.

2.4. Aims and Objectives of Study I

The aim of this study was to examine the characteristics of mothers giving birth to low birth weight babies compared with mothers having infants weighing over 2.5 kg.

This study was designed to achieve the following objectives:

(1) To examine the relationship between maternal characteristics and birth weight, head, chest circumference and length.

(2) To compare the haemoglobin levels of Saudi pregnant women at first visit to antenatal clinic and delivery in relation to birth weight.

(3) To examine the influence of antenatal care patterns on outcome of pregnancy.

2.5. Methodology

This study examined the relationship between factors during pregnancy and the outcome as indicated by baby's weight, length, head circumference and chest circumference. The study was based on antenatal and delivery records. The following data was collected:

(1) Identification numbers of antenatal and delivery records of mother and baby.

(2) Mother's age, height and gestational age.

(3) Gravida, para, and number of living children.

(4) Haemoglobin and haematocrit levels at the first visit of pregnant women to antenatal clinic and before delivery. The date of test was also recorded.

(5) Total number of visits to antenatal clinic and mother's condition.

(6) Baby's sex, weight, length, head circumference and chest circumference.

(7) Date of delivery and discharge date of mother and baby from hospital.

2.5.1. Sampling Procedure

All antenatal records for Saudi pregnant women who delivered between 6-12, 1406 A.H. (10 February - 4 September, 1986) were received from medical records at Mother and Children Hospital (MCH) in Dammam. The records were arranged according to date of delivery. Then the required data were collected from antenatal and health records of mothers, in addition to some of baby's health records and recorded on a special data sheet (see Appendix III). Any babies for whom no maternal antenatal record was available were not included in the study.

The study sample comprised each low birth weight baby and the next two successively delivered babies drawn from all data sheets. A total of 46 babies with birth weights 2.500 kg and below were identified from delivery records and paired with the corresponding antenatal records for their mothers. Records for the two successive normal weight deliveries, 92 babies, were also paired with their mothers' antenatal records. Delivery data for the 138 infants and information from antenatal records was coded for computer and analyzed using a computer package (Statistical Package for Social Science). The statistical significance of associations between variables was determined by chi-square analysis and Student's t-test. Associations were considered statistically significant at the 0.05 level.

The data for all birth records from which the sample was drawn is shown in Table 2.1.

TABLE 2.1

Distribution of Saudi babies according to their birth weights
During 1986* in MCH

Month	3.000 and more (kg)	2.501-2.999 (kg)	2.500 and less (kg)	Total
February	79	17	5	101
March	115	28	8	151
April	116	26	11	153
May	74	18	1	93
June	85	21	5	111
July	102	20	9	131
August	113	29	7	149
TOTAL	684	159	46	889

* Only babies for whom complete antenatal records were available are included.

The overall percentage of low birth weight babies during seven months (February - August) in 1986 was 5.2%, which was lower than that reported by others (6% by UNICEF, 1986, 7.7% in Saudi Arabia by Krueger, 1988). The average number of live births per month was 127 babies. Of 46 LBW babies, there were 80% SFD, and 20% premature, while only 1% of the normal birth weight babies was born prematurely. In Sharja (UAE), Magahed (1986) reported 11.9% overall LBW in his study, 72% were premature, 16% SFD and 12% were SFD and premature together.

The distribution of studysample is shown in Table 2.2.

TABLE 2.2

Distribution of study sample of Saudi babies according to their birth weight

Month	2.501 and more (kg)	2.500 and less (kg)	Total
February	10	5	15
March	16	8	24
April	22	11	33
May	2	1	3
June	10	5	15
July	18	9	27
August	14	7	21
TOTAL	92	46	138

2.6. Infants' Characteristics

The characteristics of the study infants are summarized in Table 2.3. There was no significant difference in the proportions of males and females found in normal birth weight and low birth weight groups.

As would be expected, there were significantly more premature babies in the LBW group (20%) compared with normals (1%). In addition these babies were significantly shorter ($P<0.000$) and had significantly smaller ($P<0.000$) head and chest circumference measurements than normal birth weight babies.

TABLE 2.3

Infants' characteristics

	Low Birth Wt ($\leq$2.5 kg) N(46)	%	Normal Birth Wt (>2.5 kg) N(92)	%	Total	%
Weight (kg)	46	33.3	92	66.7	138	100
Mean	(2.3 ± 0.3)		(3.2 ± 0.4)		(2.9 ± 0.6)	
Gestation Age (wks)						
30 - 36	9	20	1	1	10	7
37 - 38	10	22	9	10	19	14
39 - 41	25	54	69	75	94	69
$\geq$42	2	4	12	13	14	10
Mean	(38 ± 2.7)		(40 ± 1.2)		(39.6 ± 2)	
Total	46	100	91	100	137	100
Baby Sex						
Female	23	50	47	51	70	51
Male	23	50	45	49	68	49
Mean (F)	(2.3 ± 0.2)		(3.1 ± 0.4)		(2.9 ± 0.5)	
Mean (M)	(2.2 ± 0.4)		(3.3 ± 0.4)		(2.9 ± 0.6)	
Total	46	100	92	100	138	100
Baby Length (cm)						
$\leq$50	44	96	61	66	105	76
>50	2	4	31	34	33	24
Mean	(46.7 ± 2.9)		(49.6 ± 1.8)		(48.6 ± 2.6)	
Total	46	100	92	100	138	100
Baby Head (cm)						
$\leq$35	44	98	78	85	122	89
>35	1	2	14	15	15	11
Mean	(31.3 ± 2.6)		(34 ± 2.6)		(33.1 ± 2.9)	
Total	45	100	92	100	137	100
Baby Chest (cm)						
$\leq$35	45	100	87	95	132	96
>35	0	0	5	5	5	4
Mean	(29.1 ± 2.0)		(32.5 ± 1.7)		(31.4 ± 2.4)	
Total	45	100	92	100	137	100

2.7. Characteristics of Mothers and Influence of Factors on the Outcome of Pregnancy

2.7.1. Biological Factors

TABLE 2.4

Biological factors and pregnancy outcome

	Low Birth Wt ($\leq$2.5 kg) N	%	Normal Birth Wt (>2.5 kg) N	%	Total	%
Mothers' Age (yrs)						
14 - 19	13	28	8	9	21	15
20 - 29	24	52	65	71	89	65
30+	9	20	19	20	28	20
Mean	(23 ± 5.6)		(25.6 ± 5.5)		(24.9 ± 5.6)	
Total	46	100	92	100	138	100
Height (cm)						
<150	10	24	21	23	31	23.5
$\geq$150	32	76	69	77	101	76.5
Mean	(152.8 ± 6.4)		(153.6 ± 6.0)		(153.3 ± 6.1)	
Total	42	100	92	100	132	100

Mothers of low birth weight babies had a significantly lower ($P<0.03$) mean age than mothers of normal birth weight babies. A substantial number of mothers in both groups were aged below twenty; however these represented 28% of LBW mothers compared with only 9% of those who had babies with normal birth weights. Although the mean height of LBW mothers was less than that of NBW mothers, in this study there was no significant difference between the heights of mothers in the two groups. This may be a reflection of the population using the hospital, who perhaps did not represent a sufficiently wide range of social groupings to reflect this association (although there were significant associations between height and parity, with taller mothers having fewer pregnancies).

2.7.2. Obstetric History

TABLE 2.5

Obstetric history and Pregnancy outcome

	Low Birth Wt (≤2.5 kg) N	%	Normal Birth Wt (>2.5 kg) N	%	Total	%
Gravida						
1 - 4	34	74	52	56	86	62
5 - 10	9	20	31	34	40	29
11+	3	6	9	10	12	9
Mean	(3.7 ± 3.0)		(5.0 ± 3.0)		(4.6 ± 3.0)	
Total	46	100	92	100	138	100
Parity						
1st pregnancy	13	28.3	7	7.6	20	14.5
1 - 4	25	54.3	60	65.2	85	61.6
5 - 12	8	17.4	25	27.2	33	23.9
Mean	(3.2 ± 2.5)		(3.9 ± 2.6)		(3.7 ± 2.6)	
Total	46	100	92	100	138	100
Number of Living Children						
1st pregnancy	13	29.5	7	7.6	20	14.7
1 - 4	25	56.8	61	66.3	86	63.2
5 - 11	6	23.7	24	26.1	30	22.1
Mean	(3.1 ± 2.5)		(3.7 ± 2.4)		(3.7 ± 2.6)	
Total	44	100	92	100	136	100

A significantly higher proportion of LBW mothers were in their first pregnancy. This might have been a reflection of the higher proportion of younger mothers in the LBW group. However, parity (although not gravida or number of living children) was significantly related to birth weight, even when controlled for age. In the 20-29 age group, 33% of mothers of LBW babies were primipara, compared with only 9.2% of mothers of NBW babies. Nonetheless gravida was significantly related to the baby's head size, even when controlled for age (see Table 2.1A in Appendix II).

2.7.3. Haematology

TABLE 2.6

Haematology and pregnancy outcome

	Low Birth Wt (≤2.5 kg) N	%	Normal Birth Wt (>2.5 kg) N	%	Total	%
Hb at 1st visit (gm/dl)						
8.3 - 9.9	5	11	6	7	22	8
10 - 10.9	12	27	28	30	40	29
11 - 11.9	11	24	31	34	42	31
12 - 14.3	17	38	27	29	44	32
Mean	(11.4 ± 1)		(11.4 ± 1.0)		(11.4 ± 1.2)	
Total	45	100	92	100	137	100
Hb at Term (gm/dl)						
9 - 9.9	3	7	8	9	11	8
10 - 10.9	12	26	24	26	36	26
11 - 11.9	15	32	26	28	41	30
12 - 15.5	16	35	34	37	50	36
Mean	(11.5 ± 1.2)		(11.5 ± 1.2)		(11.5 ± 1.2)	
Total	46	100	92	100	138	100
Hb Score						
-2 to -1	15	33	29	31	44	32
0	18	40	41	45	59	43
1 to 3	12	27	22	24	34	25
Mean	(-0.1 ± 1)		(-0.1 ± 1)		(-0.1 ± 1)	
Total	45	100	92	100	137	100
Hct at 1st visit (%)						
24.9 - 32.9	14	36	29	35	43	35
33 - 42	25	64	54	65	79	65
Mean	(34 ± 3.8)		(34 ± 3.3)		(34 ± 3.4)	
Total	39	100	83	100	122	100
Hct at Term (%)						
27 - 32.9	14	32	25	27	39	29
33 - 45	30	68	67	73	97	71
Mean	(34.5 ± 3.6)		(34.6 ± 3.5)		(34.6 ± 3.6)	
Total	44	100	92	100	136	100
Hct Score (%)						
-1	5	14	10	12	15	12
0	26	70	59	71	85	71
+1	6	16	14	17	20	17
Mean	(0.03 ± 0.6)		(0.05 ± 0.5)		(0.04 ± 0.5)	
Total	37	100	83	100	120	100

According to WHO standards (Hb <11 gm/dl), 37% of all the mothers were anaemic at the first visit. A significant ($p<0.02$) relationship was found between Hb and Hct levels at first visit and the trimester of pregnancy of the mother at that time. Mothers who made their first antenatal visit in the first trimester had significantly higher HB and Hct levels. This is consistent with the natural process of decline because the increase in the plasma volume is greater than that of red blood cells (Hytten, 1980).

However, there was no statistically significant difference in the haemoglobin levels of mothers in the two groups. At term there was no change in the distribution of haemoglobin levels and no association with birth weight or any other infant measurements.

About one-third (35%) of all study mothers had low haematocrit levels at first antenatal visit and this dropped to 29% of all mothers at term. Changes in Hct score among these mothers support the finding that there was no significant relationship between Hct and the outcome of pregnancy in terms of birth weight or any other measurements.

2.7.4. Antenatal Care

TABLE 2.7

Antenatal care and pregnancy outcome

	Low Birth Wt (≤2.5 kg)		Normal Birth Wt (>2.5 kg)		Total	%
	N	%	N	%		
Stage of Pregnancy at 1st visit (trimester)						
First	16	35	27	30	43	31
Second	20	43	40	44	60	44
Third	10	22	24	26	34	25
Total	46	100	91	100	137	100
Number of Antenatal Visits						
1 - 3	8	17	18	20	26	19
4 - 7	12	26	24	26	36	26
8 - 10	12	26	29	32	41	30
11 - 13	10	22	16	17	26	19
14+	4	9	5	5	9	6
Mean	(7 ± 3.7)		(7 ± 3.4)		(7 ± 3.5)	

Mothers in both groups most commonly attended the antenatal clinic during the second trimester of their pregnancy, although a substantial proportion (25% overall) did not attend until the third trimester. However, there was no significant difference in patterns of clinic attendance between LBW and NBW mothers, either in terms of the time of first attendance or the number of antenatal visits.

As would be expected, there was a significant relationship ($p<0.000$) between the number of visits and trimester of first attendance. Although there was no relationship between birth weight and number of antenatal visits, total visit number was significantly ($p<0.04$) related to babies' head circumference.

A small number of mothers suffered from other conditions during their pregnancy, but it is not possible to draw any conclusions about the effects of these.

2.7.5. Influence of Ramadan

TABLE 2.8

Ramadan fast and pregnancy outcome

	Low Birth Wt ($\leq$2.5 kg)		Normal Birth Wt (>2.5 kg)		Total	%
	N	%	N	%		
Weeks of pregnancy when Ramadan started						
Not fell	12	30	26	33	38	32
1 - 18	8	20	16	20	24	20
19 - 28	13	32.5	12	15	25	21
29 - 40	7	17.5	25	32	32	27
Mean	(20 ± 13)		(22 ± 14)			(21 ± 13.5)
Total	40	100	79	100	119	100
Weeks of pregnancy when Ramadan started*						
1 - 18	1	5	4	10.5	5	8.6
19 - 28	13	65	12	31.6	25	43.1
29 - 40	6	30	22	57.9	28	48.3
Total	20	34.5	38	65.5	58	100

* Based only on mothers who fasted 30 days ($p<0.05$)

TABLE 2.9

Gestational age and weeks of pregnancy when Ramadan started

	Weeks pregnancy when Ramadan started									
	Pregnancy wks not fell in Ramadan		1 - 18 weeks		19 - 29 weeks		29 - 40 weeks		Total	%
	N	%	N	%	N	%	N	%		
Gestational Age (wks)										
<37	2	5.3	1	4.2	5	20	0	0	8	6.7
37 - 38	4	10.5	2	8.3	6	24	3	9.4	15	12.6
39 - 41	30	78.9	18	75.0	12	48	22	68.8	82	68.9
≥42	2	5.3	3	12.5	2	8	7	21.9	14	11.8
Total	38	100	24	100	25	100	32	100	119	100

($P<0.02$)

For 68% of all mothers, Ramadan occurred during the course of their pregnancy (Table 2.8). When only mothers who had experienced the full 30 days of the fast were considered, there was a significant relationship between birth weight and the trimester in which Ramadan occurred. Ramadan fell in the second trimester for 65% of these LBW mothers, compared with 32% of the normal birth weight mothers (Table 2.8).

Mothers who were in their second trimester when Ramadan began were also more likely to give birth prematurely (<37 weeks) (Table 2.9).

2.8. Conclusion

Having examined data from mother-child pairs delivered at Dammam Hospital, Saudi Arabia (92 normal birth weight, 46 low birth weight), a number of factors were found to be significantly associated with birth weight. Low birth weight babies were more likely to be born to mothers who were younger, mothers who were in their first pregnancy and mothers who were in their second trimester during the Ramadan fast. Other factors such as maternal height, haemoglobin and haematocrit levels, and patterns of antenatal care, as indicated by the timing of the first visit and total visits, were not associated with birth weight, although the number of antenatal visits was significantly associated with baby's head circumference.

2.9. Discussion

A number of factors have been associated with low birth weights and this small study has provided an opportunity to explore the contribution that some of these may make to the low birth weight statistics in Saudi Arabia.

The nature of the antenatal data to which access was possible meant that factors such as pregnancy weight gain, birth intervals and socio-economic factors could not be considered. Both socio-economic status and race are known to influence reproductive risk in any population (Greenberg, 1983; Illsley, 1983; Zuckerman *et al.*, 1984). Studies on predominantly black adolescents show results different from those obtained from studies on predominantly white adolescents (Naeye, 1981; Elster, 1984; Hardy *et al.*, 1987).

Nonetheless the predicted relationship between age and low birth weight did appear in this sample of Saudi mothers, and is of special significance in view of the pattern of marriage and childbearing in Saudi Arabia. Sebai (1984) has reported the average marriage age is 16-18 years, with pregnancy occurring as soon as possible afterwards. However, age at marriage varies with regions, and others have reported the average age at first marriage among Saudi women was 18.25 years old in Riyadh, with mean age at first pregnancy 19.57 years (Al-Abdul Jabbar and Wong, 1988).

The increased risk of low birth weight in a first pregnancy appeared amongst these mothers in Dammam and it is possible that the hazards after 4+ pregnancies may also contribute to LBW in Saudi Arabia since a substantial minority, 22% of all study mothers, had 5 or more children, and these findings are supported by other researchers (Ba'aqeel, 1989). This pattern of family size is consistent with Sebai's survey (1984) in the Eastern province showing that 6 children was the preferred number. The reason that a higher birth order effect was not apparent amongst mothers in this study may be due to their socio-economic background which may have protected them from the hazards resulting from a combination of higher parity and social disadvantage. However, Ba'aqeel *et al.* (1989) study showed that grand multiparity and nulliparity in Saudi community in Riyadh were significantly associated with poorer outcome, but they were unable to find a significant association between maternal age of 18 years or less and poor pregnancy outcome.

Magahed (1986) found in Sharjah (UAE) that LBW mothers were significantly shorter than controls and a higher proportion of them suffered from anaemia. In addition, Ba'aqeel *et al.* (1989) reported that Saudi mothers were shorter than non Saudi ($\leq$150 cm) and that height was associated with poor outcome of pregnancy. However, in this study no association was found between height and birth weight, which may be because subjects were a fairly homogeneous and prosperous group. This could similarly explain the absence of any effect of haemoglobin on birthweight. In the same study, Ba'aqeel and co-workers also found a significant association between lack of antenatal care and birthweight, which was also absent in the present study - although a total of 10 or more antenatal visits was significantly associated with an improvement in haemoglobin at term.

It is therefore particularly interesting to note that even in this relatively advantaged group of mothers in Dammam, that fasting for the full 30 days of Ramadan in the second trimester was associated with low birth weight. This finding is supported by the study of Prentice *et al.* (1983) which showed a poor outcome in pregnant Gambian women who fasted during Ramadan, but the outcome of the control group was not reported. In contrast, Malhotra *et al* (1989) found a satisfactory obstetric outcome in a small group of mothers fasting during Ramadan and there was no significant difference from the control group. They also noted that the higher values for insulin and lactate seen at the end of Ramadan fast day were associated with lighter, thinner babies. During the second half of pregnancy a rapid acceleration in the growth rate of the fetus and maternal reproductive tissues occurs (Naismith, 1981). However, fasting Saudi mothers might not put on as much body fat during the second trimester, if poor nutritional intake is further restricted by fasting. The influence of maternal weight gain on fetal growth has been well documented. And Bissenden *et al.* (1981) have shown that Asian mothers who gave birth to a well-grown baby by European standards, did lay down more body fat during the second trimester and showed biochemical features of better nutritional status.

For this reason it seemed to be particularly important to consider the eating habits of women during pregnancy, with particular reference to the influence of Ramadan, and this was the subject of the second study undertaken.

CHAPTER III

FACTORS INFLUENCING FOOD HABITS AND MATERNAL DIET DURING PREGNANCY

3.1. Introduction

3.2. Factors Influencing Food Habits and Diet in Pregnancy

3.2.1. Availability of Food and Seasonal Variation

3.2.2. Availability of Food and Income

3.2.3. Intra Family Food Distribution

3.2.4. Dietary Beliefs and Practices

3.2.5. Islam and Its Influence on Eating Habits

3.2.6. Aversion, Craving and Pica

3.2.7. Appetite and Morning Sickness

3.3. Summary

"Al-Miᶜdatu baitu d-da', al-himyatu ra'asu dawa'"

"The stomach is the source of disease. Prudent diet is the best method of healing"

المعدة بيت الداء

والحمية رأس الدواء

3.1. Introduction

Food intake of the mother is a primary determinant of her nutritional status and depends on the acceptability and availability of food. Both of these are influenced by several factors. Availability is influenced by income, seasonality and intra-family distribution and the acceptability is influenced by dietary beliefs, religion, food preference and state of health. These factors interact and may affect nutritional status of the mother and her baby.

Income is a major determinant of the quality and quantity of household diet. It is generally believed that as income increases, the food availability in the household would increase and this may improve the mother's nutritional status. In low income countries, females with larger families and resource constraints means fewer *per capita* resources and the quantity and quality of the household's diet may suffer (Wray, 1971). However, some studies have shown that large household size may not have deleterious effects on income and food availability, since children may contribute to an increase in total family income (Russell, 1976). But in the situation of large family size and resource constraints intra-household food distribution may prevent any significant positive effects on the nutritional status of women. Additional energy and time expenditure imposed on the mother to take care of more children and perhaps to assume roles outside the household may limited any potential benefits.

Disproportionate distribution of food and nutrients through the portion of food served and consumed within the household, favours males and this might be an important factor contributing to the sex bias in nutritional status found in many societies and women eating last and least (Valenzuela *et al.*, 1979; Chen *et al.*, 1981). Availability of food has been shown to be seasonal in many regions, but the effect on females relative to other segments of population is seldom reported (Annegers, 1973). Howver, other studies have shown a seasonal effect on weight gain during pregnancy (Thomson *et al.*, 1966).

Acceptability of available foods in the environment is influenced by cultural factors and dietary beliefs which impose restrictions on the consumption of certain potential foodstuffs. These food taboos and beliefs very frequently affect women and children (Jelliffe and Jelliffe, 1967). For instance, documented food taboos characteristically involve the prohibition of protein foods for pregnant women (Bolton, 1972; Wilson, 1973; Kusin *et al.*, 1979). Many customs also involve the consumption of special foods for mothers and these may be influenced by beliefs concerning the hot/cold classification of foods. Occasionally food preferences and prohibitions have their origin in religion and usually are transmitted by the older members of the family to the new generation. In Islam, food is a gift from Allah and should be shared and enjoyed. Dead animals, blood, pork and alcohol are prohibited. Fasting in Ramadan is a form of worship. Children, pregnant and menstruating women, sick people and travellers are exempt and should make up the lost days at other times, when possible.

Cultural practices, taboos and resulting eating habits which are not seen to be conducive to good health are frequently considered to represent evidence for the "ignorance" of mothers in Third World countries and education is considered to be a factor which can influence and improve food habit during pregnancy. Education appears to increase the ability to absorb new ideas and understand the relationship between health and food intake. In addition, education can affect the way households allocate their available income and time to food and other expenditures.

The influence of mass media on food habits cannot be ignored. Manufacturers usually create desires for their products by appealing to the emotions. Then food will consequently be purchased to fulfil these emotional needs, rather than their nutritional content (Robinson, 1973).

Jelliffe (1972) reported that Western advertising techniques have been used in developing countries with an emphasis on convenience foods. This advertising has played a major role in influencing the food habits and beliefs of the consumers in the Gulf area due to the existence of high purchasing power and low educational levels. In Bahrain it was found that 48.5% of housewives purchased the food seen in the television advertisements and this tendency decreases as the social class increases (Musaiger, 1982).

3.2. Factors Influencing Food Habits and Diet in Pregnancy

3.2.1. Availability of Food and Seasonal Variation

Due to the efforts of the Saudi Government in improving food production, food storage, food subsidies and transportation, food can be found available in local markets, supermarkets and groceries to household throughout the year. However, the type and quantity of food available are affected by seasonal variation. The latter is bound up with seasonal patterns in agriculture, work, energy expenditure and disease. Studies of tropical farmers indicate the concurrence of seasonal food shortages, high demands for work, high morbidity and mortality, malnutrition and financial problems. During these conditions, women's health has been more adversely affected than males (Hamilton *et al.*, 1984).

Seasonal effects on nutrient intakes among adult females relative to other segments of the population is seldom reported. Seasonal variation in dietary intake of Kenyan pregnant women was most pronounced for vitamins A and C. Peaks of these two vitamins coincide with the availability of leafy vegetables and yellow pumpkins. Energy and protein peak intakes were observed at the end of the year and a trough in rainy season (May - June) in rural Kenya (Kusin *et al.*, 1984).

Changes in energy expenditure and body weight have also been linked to seasonal work patterns (Hunter, 1967; Brun *et al.*, 1981). A Ghanaian study has shown a significant difference in averaged seasonal weight losses between men and women, suggesting that the nutritional status of women was more susceptible than that of men during deprivation periods (Hunter, 1967).

Other studies have also shown a seasonal effect on weight gain during pregnancy (Thomson *et al.*, 1966). Whitehead and others (1978) found that during the wet season women in the last stage of pregnancy lost an average of 1.4 kg. The prevalence of low birth weight was also observed in The Gambia during seasonal fluctuations. The daily energy intake of these women was 1350 - 1450 kcal during the rainy season (Prentice, 1980).

3.2.2. Availability of Food and Income

In rural areas of Saudi Arabia, people are involved in growing and producing food for family consumption and also generating income, which is very low. In contrast, urban people must depend on their income, and food has to be bought and not produced. Although some city dwellers may have small gardens producing vegetables.

Income without any doubt is a major determinant of quality and quantity of household diet. Lack of money (when food needs to be purchased) may limit the food availability and dietary choice of low income groups to mostly starchy foods and limited amounts of animal foods (Poleman *et al.*, 1973). As the income increases, the calories obtained from starchy foods decreases and more calories are obtained from animal products (Hamilton *et al.*, 1984). However, in affluent populations, an increase in income of the people may cause a decrease in calories from starchy foods (bread and cereals) and an increase in calories from refined sugar (Colienda, 1979). The proportion of income spent on food shows a variation between low and high socio-economic groups, particularly in cities of developing countries and also in Britain (Thomas, 1988). The lowest income groups spend a higher proportion of their money on food as compared with more affluent income groups, who spend it on clothing, transportation and recreation. However the former groups may be vulnerable nutritionally when financial strains occur.

In many societies women contribute to the household income and this would increase household food availability and also increase her economic value to the family unit, while within some cultures women are not seen as economically central (Valenzuela, 1978; Horowitz, 1980). However, research shows that improving household income may not improve food availability and nutritional status of women (Hamilton *et al.*, 1984), because the prevailing patterns of intra-household food distribution may prevent any significant positive effect on the nutritional status of women.

3.2.3. Intra-Family Food Distribution

The distribution of food within a household has both a physiological and socio-cultural basis. The physiological basis is influenced by factors such as differences in sex, age and physical activity. Various socio-cultural bases may influence food distribution by social and economic position of members in their household and social function of food in the household and society.

In most societies men are dominant and differences in position will generally lead to inequalities in the distribution of food and nutrient intake. Thus meat is often considered as the husband's food as found in North America (Lewin, 1943), Ghana (Sai, 1962), Lebanon and other parts of the Middle East (Cowan *et al.*, 1964). In Saudi Arabia no information is available on this practise in urban areas; however Sebai (1984) indicated that nomad adult men eat together form the main dish, leaving the leftovers for the women and the children.

In the Caribbean the diets of adult men were also found to be adequate, but the diets of women and children suffered and were found to be low in calcium, vitamin A and riboflavin (May and McClellan, 1973). Similar findings in the Philippines shows fathers tended to have better diets than mothers and that male children had better diets than female children at all ages. This pattern holds strongly for protein intake. However, vitamin A and C intakes do not generally show a sex difference among children, but a difference between parents and children is apparent (Valenzuela, 1978).

In some societies this practice may stem from respect toward the husband who is doing the hard physical work and acts as protector of the household, or perhaps express the women's affection and love towards their husbands and children.

The sequence of eating and serving may influence the amount and quality of food available to some members of the family. In many societies members with more prestige in the family will receive their food first, leaving less food and poorer quality food for other members. Frequently women eat last and least at a meal (Valenzuela *et al.*, 1979; Chen *et al.*, 1981).

A study in Madurai, India, showed that pregnant women ate the remaining food after all the family members had their food. The glaring deficits in their food intake in terms of cereals, pulses, vegetables and milk were reflected in their nutrient intakes of energy, vitamin A and iron (Devadas and Easwaran, 1986). Sometimes the method of serving food is affected by household size (Musaiger, 1984).

In Bahrain, 13.2% of families, particularly in the rural areas, segregate the sexes during eating. The best quality and quantity of diet is presented to men and the other to the women and children under seven. However, 71.6% ate together, from the same plate with a favour of high protein foods to older members. This is probably because women are not seen as economically central. As a woman's contribution to the household income increases, her economic value to the family increases (Valenzuela, 1978; Horowitz, 1980), which might give her freedom in decision making and control over resources such as food. However, there is little evidence which indicates the effects of this situation on women's food intakes.

3.2.4. Dietary Beliefs and Practices

Cultural factors such as beliefs, attitudes and customs, may play a role in food consumption during pregnancy in quantity as well as in quality. The taboos and restrictions which penetrate deeply into the life of the individual and community vary from place to place.

What constitutes "food" is culturally defined and within that classification the foods which are considered appropriate to age, sex and condition may be further delineated. Pork consumption is taboo for Jews and Muslims by a religious law, and also is restricted by certain beliefs among some black Americans (Cassidy, 1982). Other food taboos are green papaya which is believed to cause miscarriage because it has no seed inside and also rabbit which is believed to cause a cleft palate for a baby (Manderson and Mathews, 1981).

Dietary practice and behaviour in many countries, including those in the Gulf region, may be derived from the system of humoral medicine described by Hippocrates in the fifth century B.C., in which the body was seen as composed of four humors, blood, phlegm, black and yellow biles (Harwood, 1971; Bürgel, 1976; Manderson and Mathews, 1981; Cassidy, 1982). Each humor was associated with properties of heat and cold, moisture and dryness, and good health consisted of keeping these bodily components in balance. This system referred to classification of foods as heating, cooling and neutral, which is not related to temperatures of the food served, but rather to intrinsic qualities of the foods and their perceived effect on the body. In addition, foods in this system are considered medicines which maintain balanced states of health and can treat much illness through a careful balancing of intake and dietary management (Snow and Johnson, 1978; Cassidy, 1982; Van Esterik, 1985). The effect of hot/cold beliefs on food habits are found in many groups around the world. It has been reported among Puerto Ricans (Harwood, 1971; Libeberman, 1979), American-Mexicans (O'Grady, 1973), Chinese (Tan and Wheeler, 1983), Malays (Chen, 1972; Chen, 1973), Vietnamese (Manderson and Mathews, 1981), Black Americans (Jerome, 1980) and Indians (Rao, 1981; Gopaldas *et al.*, 1983).

In most humoral systems it is believed that women during the first trimester of pregnancy are in a cold state as they were before conception. During the second trimester, they move to a neutral state. Towards the end of pregnancy they become hot. Dietary restrictions imposed throughout pregnancy, aimed to correct imbalance (Mathews and Manderson, 1981). For example, Malay dietary practices involve the avoidance of hot foods in the first trimester to prevent miscarriage and in the third trimester to promote easy delivery, while in the second trimester neutral foods are preferred (Manderson, 1981). Hot or cold foods which are prescribed or proscribed during pregnancy are varied among different cultural groups.

Among the Vietnamese, hot food might include ripe mango, ginger, and black pepper and coffee, while cold and neutral foods might include mung beans, green coconut, spinach, melon, green papaya and steamed rice and pork respectively (Manderson and Mathews, 1981). However, in India, fruits (melon, mango) and vegetables (cucumber) are cooling foods, while jack fruit, cheese, coconut, meat and egg are hot foods (Rao, 1984).

Preference and avoidance of special foods during pregnancy was also noted among mothers in the Gulf areas (Ali, 1981; Musaiger, 1982; Prakash *et al.*, 1984). Fruits, milk and rice, generally considered cooling/neutral foods, were the most desired foods, whereas spicy food, meat and coffee were the most disliked. So it seems traces of the hot/cold concept exist in the Gulf area culture.

3.2.5. Islam and Its Influence on Eating Habits

Religion may have a profound influence on dietary behaviour by decreeing what people should or should not consume. Food habits of the Saudis are profoundly influenced by the Islamic instructions that relate to food and diet. These can be summarized as follows:

(1) The prohibited and permissible food of the animal kingdom is well defined. The flesh of herbivore animals that have cloven hooves and chew the cud are permissible, but all carnivores and swine are prohibited. The most obvious reason for prohibiting the consumption of swine flesh is based on the fact that hogs are filthy, eating whatever they can find. In addition they can be the hosts for many external and internal parasites, such as tapeworm, which can be transmitted to humans.

(2) Dead animals and blood are prohibited for the following reasons:
(a) Death could be a result of disease, causing a health hazard; (b) The blood of the dead animal contaminate the flesh; (c) The time is not known when the micro-organisms have started to contaminate the flesh; and (d) A great difference exists between a slaughtered animal and a dead one. An individual can judge the state of health of the animal before its slaughter for health hazards.

(3) Permitted animals have to be slaughtered in the name of Allah before their flesh can be consumed. If it is not easy to do it that way, it is permitted to eat what the Jews and the Christians eat, except whatever is prohibited by name in the Quran.

(4) The plant kingdom is open to consumption. Some species named in the Quran (grains and fruit) are recommended.

(5) If a Moslem eats what is prohibited in cases of ignorance of emergency, Allah is forgiving.

(6) The strangled, the dead through beating, the dead through falling from a height, that which has been killed by the goring of horns and those devoured by wild beasts are all prohibited.

(7) What has been captured by trained hawks, hounds, cheetahs or other animals used in hunting, are allowed as long as they are under the control of their master, who must release them in the name of Allah.

(8) Honey from bees is a recognized food, recommended by the Quran for use in certain remedies.

(9) All the plants that are nutritious can be consumed (El-Bana, 1979).

Islam encourages humans to eat and drink without being prodigal and to select whatever edible food Allah creates. A few foods are recommended by the Quran, such as;

(1) Breast Milk: there are many parts of the Quran which indicate that the mother's milk is the best food for the baby during the lactation period of two years. In recent years, science has proved that breast milk is necessary for infant life and growth, facts that were indicated by the Quran many years ago.

   (a) "The mothers should suckle their offspring for two whole years".

   (b) "In pain did his mother bear him and in pain did his mother give birth to him. The carrying of the child to his weaning is a period of thirty months".

(2) Lentils, Vegetables (green herbs, cucumber, garlic, onions, squash, corn, olives) and Fruits (dates, grapes).

(3) Other parts of the Quran mention a variety of drinks such as milk, pure water, pure honey and wine (in heaven).

(4) Other foods are also recommended by the Prophet Mohummed (PBUH). He once said "if my nation knows what benefits lie in the fenugreek seeds, they

will buy it even with gold". The Prophet Mohummed (PBUH) also liked to eat dates with butter, and sometimes he ate water melon with them, and his wife (Isha) said that the best drink for the Prophet was honey (Ali, undated).

Saudi people celebrate different religious occasions in the year, such as Ramadan, Eid-Al Fitr (at the end of the 9th month of the lunar calendar) and Eid-Al-Adha (12th month of the lunar calendar). Ramadan is the ninth month in the Islamic calendar and throughout this month, healthy Muslims, not on a journey, fast strictly from dawn until sunset. Menstruating women are forbidden to fast and should make up the lost days later in the year. Women who are pregnant or breast feeding are also allowed to break the fasting rules, for their health and the health of their baby. Ramadan is a hard time for women, in addition to fasting, they have to cook special meals requiring hours of preparation, as well as caring for and feeding the children every day, unless they have servants to care for them. Meal time are at sunset and during the night, which is also a time for visiting and socialising. Saudi families cook the usual food in addition to soups, fruit juices, desserts and dates. Fish is not recommended during Ramadan because it is believed to make a person thirsty before fasting. At the end of the fast, people also celebrate Eid-Al-Fitr with a meal of cooked rice with meat, sweets, coffee and tea. However, during Eid-Al-Adha, every household has to slaughter an animal and the meat is distributed to the relatives and the needy.

Saudis do not eat gelatin, which is used in jelly, because they believe that it is derived form the pig, which is forbidden in Islam. In addition, there is also a widespread belief in the society that tomato juice is beneficial to health because it increases the volume of blood. This is perhaps because tomato juice looks similar to blood. Eating fish is believed to be incompatible with drinking milk, because this affects the digestion.

3.2.6. Aversion, Craving and Pica

Cravings and aversions are powerful urges toward or away from foods and are commonly associated with pregnancy. The most frequently craved foods are sweet food and dairy products, whereas the most common aversions are coffee, meats. Nutritionally most cravings result in increased intake of calcium and energy, while aversions often result in decreased intake of animal proteins. More often unsatisfied cravings are thought by mothers to mark the child before birth, or it may alter the child's physiology or personality (Cassidy, 1982). Dietary restrictions and superstition during pregnancy, which are to ensure an easier delivery or to prevent digestive disturbance and harming the baby, have been noted in many ethnic groups (Jelliffe and Bennett, 1961; Saadarten, 1967; Churchill and Kanawati, 1971).

Craving for non-food substances (pica) is common in many areas of the world, and various explanations for this practice have been put forward (Vemeer, 1971; Hunter, 1973; Lackey, 1982). Culture and tradition was often referred to in early explanations of pica. Women's early roles as gardeners and potters led them to consume clay and passed this habit along to their children.

According to the psychological theory, pica was explained as a response to a need that has no physiological basis, while sensory theory accounts for pica's use as a relieving factor for hunger and nauseous sensations.

However, microbiological theory explained that clay could absorb gastric juices and quiet intestinal spasms associated with worm infestation and physiological one accounts for alleviating the increased salivation sometimes noticed in pregnancy.

Evidence of pica's use in seeking to meet nutritional needs is very scanty in humans. It has been suggested that pica occurs in populations where the nutritional intake is inadequate, particularly in nutrients and clays may account for dietary supplements, as seen in Ghana (Vemeer, 1971; Hunter, 1973). However, chemical analysis of Ghanaian clay give little evidence of elements (P, Mg, Ca, K) in sufficient amounts to provide positive nutrition of benefit to the mother. In addition, consumption of a large quantity of clay may hinder absorption of certain other nutritive minerals such as zinc and iron. A higher incidence of anaemia was documented among pica than non-pica women (Lackey, 1982).

3.2.7. Appetite and Morning Sickness

A woman's health during pregnancy may influence her food habits and dietary intake. More than a half of healthy women reported an obvious increase of appetite during the first trimester and more food was eaten (Taggart, 1961). The reason for the increased appetite in pregnancy is not clear (Hytten, 1980). In contrast to the usual surge of appetite in pregnancy, some women complain of poor appetite which mostly is associated with nausea or nausea and vomiting together.

Severe "nausea and vomiting" which mostly occurs in the first trimester of pregnancy, has been shown to reduce nutrient intake, particularly energy and vitamin B_6 (Beal, 1980; Schuster *et al.*, 1985) through inadequate type of dietary intake and also to food loss due to vomiting.

Illnesses such as diabetes, toxaemia, hypertension and stress during pregnancy may also modify the appetite of women and interfere with their food intake (Robinson, 1973).

3.3. Summary

Despite the apparent importance of nutrition during pregnancy, for many women this represents a period when their eating habits are maximally circumscribed. Constrained in common with the rest of their socio-economic group by the availability of foods; constrained through cultural patterns of intrafamily distribution and sex-linked food ideologies and practices affecting all women, and finally constrained by food taboos concerning pregnancy. In some situations the pregnant woman may find her nutritional status in triple jeopardy.

The factors influencing food habits have been described and this provides a background to the second study undertaken, an inquiry into food habits during pregnancy of women attending the antenatal clinic at Dammam Hospital.

CHAPTER IV

FOOD HABITS AND PRACTICES DURING PREGNANCY

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4.9. Summary

4.1. Aims and Objectives of Study II

Data on factors influencing food habits and beliefs during pregnancy and maternal diet in Saudi Arabia is very limited and therefore this study aimed to examine various aspects of food habits of Saudi mothers attending the antenatal clinic for the first visit, particularly related to three one-month periods (Shaban, Ramadan and Shawal). These months are the 8th, 9th and 10th months of the Islamic Calendar respectively. In Shaban, needed foodstuffs are usually bought and prepared for the Ramadan fast, because during Ramadan food prices become high and women feel tired and weak. However food consumed during Shaban does not differ from the rest of the year. When Ramadan ends, the fast is broken and people celebrate Eid-Alfitr for 4 days, cooking and eating special foods and sweets and visiting relatives and neighbours. This special feasting period was not included in the Shawal study. Shaban and Ramadan were located in the spring season while Shawal was in the summer season.

This study was designed to achieve the following objectives:

(1) To investigate food habits and beliefs and haematological status of women at their first antenatal visit to MC Hospital in Dammam, with special reference to the effects of Ramadan.

(2) To assess the relationship between food habits, food intake and haemoglobin level.

4.2. Methods of Data Collection

Data for this study was collected during three four week phases; before, during and after Ramadan of 1986. Consecutive Saudi women reporting pregnant at first visit to an antenatal clinic in Maternal and Children Hospital in Dammam were interviewed by the researcher using a questionnaire in Arabic and in addition heights and weights of all subjects were measured and recorded (see Appendix IV for copy of questionnaire in English).

4.2.1. <u>The Interview</u>

Mothers were interviewed in a curtained area of the waiting room in the antenatal clinic and the following information collected.

(a) Personal data: Name, age, antenatal card number, and the date of interview.

(b) Socioeconomic data: Woman's educational level and occupation, husband's educational level and occupation and type of accommodation.

(c) Medical information: Age at marriage, age at first pregnancy, gestation age, gravida, parity, number of living children, dead children, miscarriage, haemoglobin and haematocrit levels at first visit, stool analysis, type of medication and herbs taken.

(d) Food habits: Appetite and health problems during pregnancy, craving, aversion, pica, 24 hour recall of dietary intake, food frequency checklist, food planning, supplying, preparation and cooking, food beliefs and dietary practices, meal pattern, food beliefs concerning the puerperium, intentions for infant feeding.

4.2.2. <u>Assessment of Food Intake</u>

The assessment of food intake of any population is a very hard task. The choice of method in assessing dietary intake and food consumption depends on the objectives of the study, respondents' characteristics and available resources. In this instance, a pilot study showed that most mothers would be illiterate and have many responsibilities towards home and children, and in addition research resources were limited.

Each method of dietary assessment has advantages and disadvantages. A food record was not a practical method of dietary assessment since the majority of pregnant women were functionally illiterate, and also this method is severely limited when the diet includes dishes of variable composition. This is especially important since most Arabian dishes are a mixture of several food items (see Appendix VI for food dictionary). Similarly, a food inventory was also inappropriate because of the high degree of illiteracy and family food purchasing pattern. Domestic duties and illiteracy also made weighed food intake impractical. Therefore, 24 hour dietary recall was the most feasible method of dietary inquiry in this group of women. It was appropriate to the objectives of the study which are concerned primarily with aspects of eating habits rather than nutrient intake. The great advantage of this method is that it does not disturb the normal routine or invade the privacy of respondents, which in the context of Saudi Arabia is a major factor. In addition, it does not involve an appreciable memory span, which increases the likelihood of obtaining a complete record (Guthrie, 1979). Unlike the food record, in this instance it is possible to question mothers in more detail about the composition of mixed dishes.

Leching and co-workers (1976), in reviewing a number of validation studies, concluded that the one day dietary recall method generally provides valid and reliable mean estimates of calories and protein intake of a study population. Other authors have expressed concern that over or under estimation of food intake may occur when this method is used (Trulson, 1954; Young, 1965; Gersovitz, 1978; Sanjur, 1982). In spite of low validity of dietary recall for assessment of an individual's food intake, it may provide a satisfactory measurement of the current intakes of groups (Chalmers *et al.*, 1952) and we are primarily interested in patterns of food habits.

Kinds and amounts of foods consumed were recorded with the aid of household measurements (cups, spoons, plates) and food models. In addition, a food frequency checklist was also used to check the accuracy of the food data. It is a simple and economical tool used successfully in epidemiological studies. It involves recording the answers to questions about the frequencies with which different foods are eaten during a given period (Abramson *et al.*, 1963).

The limitation of the food frequency method is that it only provides descriptive data. However, in this study it was employed as a validation technique in combination with the 24 hour dietary recall (Marr, 1971).

4.2.3. <u>Anthropometric Assessment</u>

The most important measurements for pregnant women are weight and height. Available instruments at the Maternal and Children Hospital were used to assess these two measurements which were taken by the researcher alone, or with the help of the nurse. Instruments were frequently checked.

Measurement Technique:

(a) Weight:

Weight was measured to the nearest 0.1 kg with a medical beam balance scale with the women in stockinged or bare feet and light clothes. The same scale was used for all women.

(b) Height:

Height was measured with a vertical scale fixed to a medical beam balance with the subject in stockinged or bare feet. The head and body were straight and arms were hanging naturally. A light metal board was placed at the top of the woman's head to read the exact value for the height to the nearest 0.1 cm.

4.2.4. Haematological Assessment

Haemoglobin (Hb) and haematocrit (Hct) are useful indicators of potential iron deficiency anaemia. Blood samples were drawn routinely at antenatal visits by laboratory technicians and then prepared and analyzed by specialized persons. The researcher also attended the laboratory for 2 days to observe and practice techniques of blood analysis used to establish Hb and Hct levels. Cyanmethaemoglobin method with photometer and microhaematocrit centrifuge were used to determine both Hb and Hct in laboratory respectively. Values of these two measurements at the first visits of respondents to the clinic were taken from their antenatal cards and then compared to WHO standards of haemoglobin and haematocrit (WHO, 1972).

Pregnant women who had haemoglobin levels less than 11 gm/dl (WHO, 1972) were requested by the researcher to have stool analysis carried out.

4.3. Study Sample

4.3.1. The Pilot Study

For item clarity and question sequencing, a pilot study of the questionnaire was conducted on 11 Saudi pregnant women during January 1986. Some modifications were then made. For example, questions on income were omitted from the final version, since most of the women were not working and they did not have knowledge of their husbands' salaries. In addition, an income classification system is not available in Saudi Arabia.

4.3.2. The Main Study

The subjects for this study consisted of 227 Saudi women who were residents of Dammam and were drawn consecutively from women reporting pregnant at the first visit to the antenatal clinic at the MCH during 3 four week periods in Shaban (80), Ramadan (71) and Shawal (76). A further twenty-two women who were invited to join the study refused to be interviewed because they did not have enough time to answer the questions, or their husbands had forbidden them to participate in the study.

Most interviews in Shaban and Shawal were carried out on weekdays from 7:30 - 13:00 and 15:30 - 19:30 hours. However, in Ramadan the time was 9:00 - 13:30 and 19:30 - 23:00 hours.

At the beginning of the interviews anthropometric measurements (weight and height) of the respondents were taken. Other information was obtained either before or after blood samples were drawn. Details of respondents taking part in the three phases (Shaban, Ramadan, Shawal) of this study are shown in Table 4.1.

TABLE 4.1

Study participation (II)

Period of Study	**Total No. of females invited to join study**	**No. of females refused to be interviewed**	**No. of females agreed to be interviewed**
1st 4 weeks (Shaban) (Apr.12 - May 7, 1986)	95	15	80
2nd 4 weeks (Ramadan) (May 10 - June 7, 1986)	74	3	71
3rd 4 weeks (Shawal) (June 14 - July 13, 1986)	80	4	76
TOTALS	249	22	227

4.3.3. Data Processing and Statistical Analysis

Data were coded and analyzed with the aid of two computer statistical packages (SPSSX and Minitab). Dietary analysis was carried out using the food TABS program at King's College London, using a special database including compositional information from McCance & Widdowson, FAO, Middle east and Bahraini food tables (Pellett and Shadarevian, 1970; Paul and Southgate, 1978; FAO, 1982; Musaiger and Al-Dallal, 1985).

The statistical significance of relationships between variables was determined by the chi-square test and analysis of variance. Relationships were considered statistically significant at a level of $p<0.05$.

4.4. Respondents' Characteristics

Participating in this study were 227 pregnant women and their characteristics are presented in Table 4.2. The mothers' ages ranged from 14-40 years with an average of 25 ± 5.9 years. The majority of mothers (58%) fell into the 20-30 age group. A substantial proportion (24%) were aged 20 years and below. Most mothers (88%) were married young (9-20 years) and of these 36% were married between the ages of 9-15 years. This age group (9-20 years) of mothers had first pregnancy at an early age with a mean of 17.9 ± 3.4 years. This finding corresponds with the first study and supports other findings that many women in Saudi Arabia are married young and have early pregnancies. Of the 227 respondents who visited the antenatal clinic for the first time, 56% were in their first trimester (≤13 weeks), 33% in the second trimester (14-25 weeks) and a minority of them were in the third trimester (26-36 weeks).

There is a strong desire amongst Saudi women to be pregnant during Ramadan. In this way they can fast with the rest of the family and avoid having to make up later on their own the days of fasting they would have lost due to menstruation. In Shaban a higher proportion (65%) of mothers visited the clinic in the first trimester. This might indicate that Saudi mothers were keen to officially acknowledge their pregnancy before the start of Ramadan.

The total means and ranges for gravida, parity and number of living children were 4.5 ± 3.0 (1-15), 3.0 ± 2.7 (1-12) and 2.8 ± 2.5 (1-12) respectively. However, gravida mean value is lower than that reported in Sebai's survey, who found the average gravida was 5.2 for the settled and 4.9 for the semi-settled (Sebai, 1981), probably due to the more affluent urbanised group represented in this study. A trend was demonstrated for higher gravida, parity and number of living children to be associated with more dead children and miscarriages, even when age was controlled. Mothers with higher gravida, parity and number of living children (1-4) were older and more likely to have been married at a young age (<20 years).

An inverse relationship was also found between gravida, number of living children and educational level (both $p<0.000$). Mothers with higher gravida and number of living children more often had a low level of education and perhaps no knowledge of family planning.

The birth interval between deliveries ranged from 12-84 months. The most common birth interval was 13-24 months (43%); however a minority (12%) reported intervals of one year. Birth intervals of more than 24 months have been associated with the most favourable pregnancy outcome (Sai, 1983) and consequently the birth intervals observed amongst this group of women are of some concern, since 55% of mothers had shorter birth intervals.

In this study there was a trend relationship between reported history of miscarriage and birth interval only when these variables were controlled for age. In the age group 30-40 years more mothers who had short birth intervals (<2 years) between two deliveries tended to have one or more miscarriages. Birth interval was found to be significantly associated with education ($p<0.02$). Fifty-four percent of mothers who had a birth interval ≤ 2 years were poorly educated as compared with only 31% of those with a birth interval of more than 2 years.

There was a high rate of illiteracy (29%) among the mothers. However, 6% of them had university education. Others (58%) had different levels of school education. About 90% were housewives and the minority (10%) worked outside the home as well. In fact women in Saudi Arabia are gradually entering the labour force and dividing their time between work and the house. These working women were characterized by having lower gravida (1-4), fewer living children (1-4), highly educated and more likely to work as professionals (nurse, teacher, etc.). However they tended to have a lower educational level than their husbands. Overall, 11% of husbands were illiterate and 15% had university level education, while the rest had different levels of school education. Most husbands (47%) worked as professionals (teachers, engineers, etc.), others were working as clerks (33%) or labourers (20%). The chance of owning a house was less for labourers and clerks than for professionals. More in the latter group (56%) tended to live in owned homes, as compared with 37% and 35% in the labourer and clerk groups respectively.

As can be observed in the table, the majority of mothers either owned their homes (45%) or rented them (45%). Only 10% of them were sharing living accommodation with members of extended families. Mothers (52%) in the age group 21-30 years were more likely to own their homes, as compared with 23% and 25% of them in the age groups of ≤ 20 and over 30 years respectively.

No significant differences were found between the occurrence of respondent characteristics in the three study periods (Shaban, Ramadan and Shawal). However, the type of accommodation did differ significantly between the study periods ($p < 0.002$). More mothers (46%) who were interviewed in Shaban were likely to own their homes, as compared with 24% and 29% in Ramadan and Shawal respectively.

TABLE 4.2

The characteristics of the pregnant women

Variable	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
Mother's Age (yrs)								
14-20	21	26	11	16	22	29	54	27
21-30	49	61	45	63	37	49	131	58
31+	10	13	15	21	17	22	42	18
Mean	24.6 ± 5.0		26.0 ± 5.5		25.0 ± 6.5		25.0 ± 5.9	
Mother's Age at First Marriage (yrs)								
9-15	29	36	25	35	27	35	81	36
16-20	41	51	36	51	41	54	118	52
≥21	10	13	10	14	8	11	28	12
Mean	17.0 ± 3.7		17.5 ± 3.7		16.9 ± 3.3		17.0 ± 3.6	
Age at the First Pregnancy (yrs)								
≤15	21	26	17	24	19	25	57	25
16-20	48	60	41	58	49	60	135	60
21-31	11	14	13	18	11	15	35	15
Mean	17.8 ± 3.7		17.5 ± 3.7		16.9 ± 3.3		17.9 ± 3.4	
Weeks of Pregnancy								
≤13 years	50	65	33	47	41	54	124	56
14-25 years	18	23	27	39	29	38	74	33
26-36	9	12	10	14	6	8	25	11
Mean	14.0 ± 8.2		16.2 ± 7.9		15.6 ± 7.3		15.0 ± 7.8	
Gravida								
1-4	49	61	41	58	41	54	131	58
5-10	25	31	19	27	31	41	75	33
≥11	6	8	11	15	4	5	21	9
Mean	4.2 ± 2.8		4.8 ± 3.4		4.4 ± 2.9		4.5 ± 3.0	
Parity								
No para	13	16	14	20	19	25	46	20
1-4	49	61	36	51	37	49	122	54
5-10	18	23	17	24	19	25	54	24
≥11	0	0	4	5	1	1	5	2
Mean	2.8 ± 2.3		3.4 ± 3.0		2.9 ± 2.7		3.0 ± 2.7	
Number of Living Children								
No children	13	16	14	20	20	26	47	21
1-4	58	73	44	62	45	59	147	65
5-12	9	11	13	18	11	15	33	14
Mean	2.7 ± 2.2		3.0 ± 2.8		2.7 ± 2.6		2.8 ± 2.5	
Number of Miscarriages								
No miscarriage	54	74	49	69	54	71	162	71
1	12	15	14	20	10	13	36	16
≥2	9	11	8	11	12	16	29	13
Total mean	0.5 ± 0.9		0.5 ± 0.9		0.5 ± 0.9		0.5 ± 0.9	
Mean (only women with miscarriage)	-		-		-		1.6 ± 0.8	
Average Birth Interval (months)								
≤12	5	10	7	14	5	11	17	12
13-24	25	50	20	41	17	37	62	43
25-35	14	28	12	25	9	20	35	24
36-84	6	12	10	20	15	32	31	21
Mean	25 ± 9		26 ± 12		29 ± 13		26 ± 11	

Table 4.2 (continued) . . . .

Variable	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
Mother's Educational Level								
Illiterate	19	24	28	39	19	25	66	29
Read + Write	7	9	3	4	7	9	17	7
Elementary	26	32	14	20	23	30	63	28
Intermediate	13	16	8	11	15	20	36	16
Secondary	14	18	11	16	7	9	32	14
University	1	1	7	10	5	7	13	6
Husband's Educational Level								
Illiterate	3	4	10	14	11	14	24	11
Read + Write	7	9	4	6	8	11	19	8
Elementary	27	34	19	27	17	22	63	28
Intermediate	20	25	13	18	18	24	51	22
Secondary	14	17	10	14	12	16	36	16
University	9	11	15	21	10	13	34	15
Mother's Work								
Housewife only	77	96	61	86	67	88	205	90
Housewife + Work Outside the Home	3	4	10	14	9	12	22	10
Husband's Work								
Labourer	14	19	13	21	14	21	41	20
Clerk	27	38	17	27	22	33	66	33
Professional	31	43	33	52	30	46	94	47
Type of Accommodation								
Owned	47	59	25	35	30	40	102	45
Rented	32	40	38	54	33	43	103	45
Shared with Others	1	1	8	11	13	17	22	10

While more mothers (59%) were sharing living with their extended families in Shawal than other months.

In the absence of other economic data inferences about the influence of socio-economic factors on food habits has had to depend in part on education and employment data in this study.

4.5. Food Ways

Food ways is a broad term used to describe socio-cultural aspects of food habits. It includes the ways of planning, preparation, cooking, eating, as well as the number of meals and food choices which helps to describe the food habits of any population in the context of culture and history.

The following section will present the findings among the study mothers in relation to food ways, and food ideology.

4.5.1. Food Planning

TABLE 4.3

Food planning

Food planner	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
Housewife	71	89	64	90	67	88	202	89
Other family member	9	11	7	10	9	12	25	11
TOTAL	80	100	71	100	76	100	227	100

As would be expected, most meals (89%) were planned by the respondents. Only 11% of planning was done by other family members and this was most commonly by the mother-in-law (3%). Meals were usually planned at the time, just prior to shopping (43%) or before cooking (44%), or one meal ahead (12%).

No significant differences existed between the three study periods regarding planning, however, a trend relationship was found between the planning and educational level ($p<0.07$). Most mothers who were poorly educated (95%)

tended to plan their own meals, as compared to 85% and 87% in the middle and high education groups respectively, who were more likely to depend on relatives to plan their meals because most of them were working outside the home.

4.5.2. Food Supply

TABLE 4.4

Food supply

Food Supply	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Husband	68	85	61	86	61	80	190	84
Respondent alone	2	2.5	1	1	3	4	6	3
Respondent + Husband	2	2.5	3	4	3	4	8	3.5
Other Family Members	8	10	6	9	9	12	23	9.5
TOTAL	80	100	71	100	76	100	227	100

As an urban sample, food supply in this instance is principally achieved through the purchase of foodstuffs, although a small number did raise chickens (2%) and plant some vegetables (7.5%) in their gardens. As in most countries in the Gulf, the respondent's husband (84%) was the major source of food supply for the household. Only 16% reported that shopping was done by one or two other family members and of them 3% and 3.5% food supply was carried out by the respondent alone, or together with her husband, respectively.

In the past food supply was entirely a man's task, but nowadays women are beginning to share in this activity. Food shopping is usually done at the local market, supermarkets, bakery and nearest groceries. Bread, milk and milk products are bought daily, while meat, vegetables and other foodstuffs are purchased either weekly or monthly.

There was no significant difference in patterns of food supply between the three study periods.

4.5.3. Food Preparation and Cooking

TABLE 4.5

Food preparation and cooking

	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Food Preparation								
Housewife	70	88	63	89	62	82	195	86
Other Family Members	9	11	7	10	11	14	27	12
Helper	1	1	1	1	3	4	5	2
Food Cooking								
Housewife	69	86	64	90	62	82	195	86
Other Family Members	10	13	7	10	11	14	28	12
Helper	1	1	0	0	3	4	4	2

In most countries in the Gulf area preparation (86%) and cooking (86%) food have been a main role for Saudi mothers. Only 12% and 12% of preparation and cooking respectively were done by other family members and each of them (2%) was carried out by a helper.

Most mothers who prepared and cooked the family's food tended to have lower gravida, parity and living children between 1-4. The highly educated mothers were less likely to prepare their own food.

Meals were usually cooked fresh by 99.6% of mothers, particularly lunch and dinner. Most of these mothers (96%) owned gas cookers and 1.8% of them either had kerosene or gas and electric together.

Eighty-one percent of mothers ate meals with their family members together and only 19% ate separately and these mostly lived within an extended family. About 96% still keep their tradition of eating on the floor and 4% of them ate at the table. Traditionally food was eaten from the same dish by 97% and 3% used separate dishes. The majority used their hands for eating (94%) and only a small minority (6%) used spoons.

4.6. <u>Meal Patterns</u>

Cultural and environmental factors influence the choice of foods selected, prepared, consumed and utilized. In addition, they affect the number of meals per day and ways of cooking and storage.

In non-fasting months, the normal pattern is 3 meals per day in Saudi Arabia. Breakfast is in the early morning, lunch at afternoon and dinner in the evening. Sometimes there is one or more snacks taken between the meals. During Ramadan there are 2 main meals, Sahoor (before sunrise) and Fatoor (after sunset). Fatoor is the most important meal, therefore it is compared with lunch which is the most important meal in non-fasting months; and Sahoor has been compared with dinner, which in non-fasting months is the secondary meal. During Ramadan there is no equivalent meal to breakfast. Data is presented concerning foods commonly eaten at each meal. In some instances there are substantial differences in the frequency with which certain foods are eaten in the non-fasting months of Shaban and Shawal which cannot be easily explained.

4.6.1. <u>Timing and Number of Meals</u>

The timing of main meals varies between non-fasting and fasting months. The average time of breakfast, lunch and dinner in the non-fasting months was 9:26, 13:49

and 21:23 hours respectively. However, in Ramadan, the average time of Sahoor and Fatoor were 2:30 and 18:34 hours respectively.

In Saudi Arabia more than half of the mothers (53%) ate 3 meals a day ($x = 2.5 \pm 0.5$) and 45% had 2 meals, while a very small proportion (2%) had only one meal a day (Table 4.6).

TABLE 4.6

Number of meals in Shaban, Ramadan and Shawal

Number of Meals	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
1	0	0	3	4	1	1.3	4	2
2	20	25	68	96	14	18.4	102	45
3	60	75	0	0	61	80.3	121	53
Mean	2.7 ± 0.4		1.9 ± 0.2		2.8 ± 0.4		2.5 ± 0.5	

As would be expected, the difference ($p<0.000$) in the number of meals consumed in the three study periods were statistically significant. The number of meals eaten during non-fasting months were mostly 3 times a day and this was higher than the number of main meals in the fasting month, which was usually 2 meals a day (Sahoor and Fatoor).

The mean number of food items consumed at the different meals in the three studied periods is reported in Table 4.7, and shows a statistical difference between them at breakfast and lunch. Mothers who were interviewed in Shawal included more food items at breakfast than in Shaban, while mothers who were interviewed in Ramadan included more food items at Fatoor. But an increased number of items in one meal than another does not mean an improved diet quality.

TABLE 4.7

Mean number of food items consumed at different meals

	Shaban	Ramadan	Shawal	Statistical Significance
Breakfast	4.1	0	4.8	$p<0.01$
Lunch	3.1	4.3 (Fatoor)	3.3	$p<0.000$
Dinner	3.0	3.5 (Sahoor)	3.3	$p<0.08$

4.6.2. Breakfast

In Saudi Arabia 87.5% and 83% of mothers ate breakfast regularly in Shaban and Shawal respectively.

Mothers usually start their daily routine praying before preparing the breakfast for the family. In non-fasting months breakfast was taken with the family by 56% of mothers and 1% with relatives. A high proportion of mothers (43%) ate alone and these were mostly housewives who had more than one child who probably would be busy with sending them to school.

Differences with whom breakfast was eaten between Shaban and Shawal were not statistically significant.

Most mothers (99%) preferred to have breakfast at home in both Shaban and Shawal and only 1% had it in a relative's home.

The most commonly eaten food items consumed by at least 5% of mothers at breakfast in Shaban and Shawal are presented in Table 4.8.

TABLE 4.8

Food eaten at breakfast[a]

Food Items	Shaban (n=70)		Shawal (n=63)	
	N	%	N	%
Milk	48	68.5	48	76.3
Cheese	19	27.1	27	42.9
Other Milk Products	5	7.1	12	19.0
Bread	54	77.1	58	92.1
Legume Dishes	4	5.7	3	4.8
Eggs	27	38.6	31	49.2
Olives	4	5.7	7	11.1
Meat and Liver	6	8.6	0	0.0
Vegetables	5	7.1	1	1.6
Fruits	6	8.6	5	8.0
Sugar	51	72.9	52	82.5
Tea	40	57.1	32	50.8
Coffee	6	8.6	12	19.0
Fizzy Drinks	4	5.7	0	0.0

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

The most common breakfast in non-fasting months consisted of tea mixed with milk and sugar accompanying bread with eggs and cheese. Evaporated milk and pitta bread are more popular among Saudi mothers than other brands such as cow's milk and Yemeni bread. Eggs are preferred boiled and sometimes consumed fried. Some foods such as legume dishes, meat and liver, olives, vegetables, fruits and coffee were consumed infrequently in both months. Legume dishes include foul moudamus, humus and falafal.

Interestingly, fizzy drinks were taken in Shaban by few mothers (5.7%) at breakfast instead of milk with tea or coffee, while no mother had it in Shawal. This might be due to the fact that more mothers who were interviewed in Shaban were in the first trimester and probably a few of them believed that fizzy drinks could relieve indigestion.

4.6.3. Lunch

In Saudi Arabia lunch is the main meal during the day in non-fasting months and Fatoor is the main meal in Ramadan. About 96% (Shaban 97.5%, Shawal 93%) and 100% ate lunch and Fatoor in non-fasting and fasting months respectively.

Preparation for lunch usually starts at mid morning and for Fatoor at afternoon. In non-fasting months all mothers had lunch at home and the majority (97%) shared the meal with family members, while in Ramadan Fatoor was taken at home by 97% of mothers sharing the meal with the family and the remainder in a relative's house.

The most frequently consumed food items by at least 5% of mothers at lunch in non-fasting months (Shaban and Shawal) and at Fatoor (Ramadan) are shown in Table 4.9.

TABLE 4.9

Food eaten at lunch[a]

Food Items	**Shaban** (n=78)		**Ramadan (Fatoor)** (n=71)		**Shawal** (n=71)	
	N	%	N	%	N	%
Leben	18	23.1	22	31.0	33	46.5
Mahalabia	0	0.0	15	21.1	0	0.0
Other Milk Products	1	1.3	3	4.2	0	0.0
Bread & Cereals	32	41.0	2	2.8	36	50.7
Mixed Dishes						
Kabsa	34	43.6	1	1.4	30	42.3
Boiled Rice	27	34.6	3	4.2	27	38.4
Thareed	0	0.0	6	8.5	0	0.0
Macaroni with Meat	4	5.1	0	0.0	0	0.0
Sambosa with Meat	0	0.0	20	28.4	0	0.0
Meat, Chicken Sauce with Vegetables	14	27.9	5	7.0	19	26.8
Meat, Liver, Fish	16	20.5	2	2.8	18	25.4
Chicken Soup + Vegetables	0	0.0	8	11.3	0	0.0
Lentil Soup	0	0.0	5	7.0	0	0.0
Quaker Oats + Meat Sauce	0	0.0	39	54.9	0	0.0
Other Foods						
Vegetables	32	41.0	9	12.7	30	42.3
Sugar Foods	1	1.3	23	32.4	1	1.4
Fruits (Orange, Apple and Water Melon)	39	50.0	8	11.2	35	49.0
Other Fruits (Banana, Grapes, etc.)	28	35.9	8	11.2	44	62.0
Dates	17	9.0	65	91.5	9	12.7
Coffee	0	0.0	6	8.5	0	0.0
Juices	2	2.6	33	46.5	0	0.0

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

Traditionally lunch in Saudi Arabia started with a few dates. However, a small number of mothers consumed them during non-fasting months which indicates this habit is dying out; but in Ramadan, the fast is usually broken by a few dates and about 91.5% of mothers did so.

Dates are usually preferred with Leben (buttermilk) which is consumed by 23.1%, 46.5% and 33.1% in Shaban, Shawal and Ramadan respectively. Leben is drunk more frequently in Shawal than other months due to seasonable availability and low prices, in addition to hot weather, which leads mothers to consume cool foods rather than others. Rice was the staple food of Saudi people and consumed by 84% of all mothers as mainly boiled rice (34.4%) or Kabsa (43.6%) or others (5.8%).

Boiled rice is usually eaten with stews (21.6%) and Kabsa with salad (30%). Rice, as well as bread and vegetables, were consumed more frequently in non-fasting times than in Ramadan.

Other mixed dishes such as stews, meat dishes, except soups and sambosa, were more popular in non-fasting months than Ramadan.

Fruits were taken at the end of the meal by more mothers in Shaban and Shawal than Ramadan. However, juices were more popular in Ramadan and were drunk during the meal. The most common fruits were oranges, apples and water-melons and the most common juices were orange and cherry.

Desserts usually eaten at the end of the meal such as mahalabia (21.1%) which is a famous dish in Ramadan as well as sugar foods (32.4%) and legimates (29.6%) was the popular one.

4.6.4. Dinner

In Saudi Arabia dinner is a regular meal in non-fasting months and Sahoor is in Ramadan. Dinner was consumed by 90% of all mothers in the non-fasting months and Sahoor was consumed by 91.5% in Ramadan.

Dinner was mostly eaten at home (98.6%) with the family (95%) in non-fasting months. About 1.4% of mothers had dinner in their relative's house and only 2.4% ate alone at home.

The most common food items were eaten by at least 5% of the mothers at dinner and Sahoor meals are presented in Table 4.10.

The common dinner in non-fasting months consisted of bread, cheese, leben, vegetables, meats and fruits; while in Ramadan the common Sahoor was mixed dishes, vegetables and fruits. Mixed dishes are usually cooked fresh or left over from Fatoor. Kabsa was the popular dish in Fatoor and also in lunch meal. Bread was consumed by few mothers in Ramadan as compared to ones in non-fasting months. Pitta bread was the preferred bread by 30.7% of all mothers.

A habit of drinking liquids during the meal, particularly at lunch and dinner, is noticeable. These liquids are water, juices, and fizzy drinks and leben. The latter is more preferred, being taken by 22.6% of all respondents.

In Ramadan, desserts such as mahalabia and sugar foods were eaten more by the mothers than in the non-fasting months. Mahalabia is a soft sweet dish consisting of milk, cornflour and sugar, and is preferred to be taken cold.

TABLE 4.10

Food eaten at dinner[a]

Food Items	Shaban (n=71)		Ramadan (Sahoor) (n=65)		Shawal (n=70)	
Milk	8	11.3	6	9.2	10	14.3
Cheese	13	18.3	0	0.0	9	12.8
Leben	11	15.5	0	0.0	15	21.4
Mahalabia	1	1.4	8	12.3	0	0.0
Other Milk Products	6	8.5	0	0.0	5	7.1
Bread	44	62.0	11	16.9	44	62.9
Legume Dishes	5	6.0	2	3.0	6	8.6
Mixed Dishes						
Kabsa	2	2.8	25	38.5	6	8.6
Boiled Rice	8	11.3	8	12.3	5	7.1
Hareesa + Meat	1	1.4	4	6.2	1	1.4
Macaroni + Meat	7	9.9	2	3.1	4	5.7
Meat Sauce + Vegetables	2	2.8	6	9.2	8	11.4
Other Foods						
Vegetables	18	25.4	13	20	23	32.9
Meats	18	25.4	4	6.2	18	25.7
Eggs	5	7.0	3	4.6	7	10.0
Tea	6	8.5	4	6.2	5	7.1
Sugar	5	7.0	6	9.2	8	11.4
Sugar Foods	1	1.4	4	6.2	0	0.0
Fruits	21	29.6	55	84.6	43	61.4
Juices	4	5.6	13	5.6	6	8.6
Fizzy Drinks	5	7.0	2	3.1	2	2.9

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

4.6.5. Timing and Number of Snacks

Snacks are light refreshments, less important than meals, and eaten at a variable and convenient time. In Saudi Arabia only 33.5% of the respondents reported to have one or two snacks during the day in the three study periods, while 66.5% never snacked (Table 4.11).

TABLE 4.11

Number of snacks in Shaban, Ramadan and Shawal

No. of Snacks	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Never	42	52.5	61	85.9	48	63.2	151	66.5
1	35	43.8	10	14.1	18	23.7	63	27.8
2	3	3.8	0	0.0	10	13.2	13	5.7

These snacks were taken at average times of 10:43, 16:56 and 22:30 hours. Differences in eating snacks among three months periods existed. More mothers consumed snacks in Shaban than Ramadan and Shawal. A snack was usually eaten between lunch and dinner during Shaban and Shawal, and between Fatoor and Sahoor in Ramadan. It was influenced by stage of pregnancy ($p<0.0005$) and mother's education ($p<0.001$). More respondents who consumed one snack were more likely to be in the first trimester and middle educated.

4.6.6. Morning Snack

About 15.9% of respondents claimed to have a snack during the morning in non-fasting months. Snack consumption was higher in Shaban (64%) than Shawal (36%) but it did not reach significant levels.

Snacking alone at home was done by a majority of mothers (89%) and only 11% in the neighbour's house.

The most common food eaten by at least 5% of mothers for the morning snack are presented in Table 4.12.

TABLE 4.12

Food eaten at the morning snack[a]

Food Items	Shaban (n=23) N	Shaban (n=23) %	Shawal (n=13) N	Shawal (n=13) %
Milk	2	8.7	1	7.7
Other Milk Products	2	8.7	0	0.0
Bread	1	4.3	1	7.7
Sugar Foods	2	8.7	1	7.7
Peanut Butter	0	0.0	1	7.7
Fruits	15	65.1	5	38.5
Dates	3	13.0	2	15.4
Other Fruits	6	26.1	8	61.5
Juices	6	26.1	0	0.0
Sugar	2	8.7	2	15.4
Tea	2	8.7	2	15.4
Coffee	4	17.4	2	15.4

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

Fruits were by far the most frequently eaten in the morning snack in both months, however apples, oranges and watermelons were more popular in Shaban, while bananas, grapes etc. were more popular in Shawal. This difference in availability is probably due to seasonal variation. Juices were only consumed by 26.1% of mothers in Shaban.

Coffee was drunk in both months and often accompanied by sugar foods (sweet biscuits and cakes). This combination of sweet and bitter flavour is a traditional one and the practice of eating dates with coffee is common in many households.

4.6.7. Afternoon Snack

In Saudi Arabia about 29.1% of the respondents claimed to have an afternoon snack in non-fasting months. No significant difference in frequency of snacking was found between Shaban and Shawal.

In most circumstances this snack was consumed at home (92.4%), either alone (57.6%) or shared with the family (34.8%). Only 7.6% of respondents had the snack with neighbours (7.6%) in their houses (7.6%).

The most common foods eaten by at least 5% of mothers in the afternoon snack are presented in Table 4.13.

Fruits and beverages (coffee, tea, fizzy drinks) were more popular in these two months. Fruit availability was also influenced by seasonal variation, as seen in the morning and afternoon snacks. Other foods (bread, milk/milk products, sugar foods, vegetables) were more consumed by mothers in Shaban than Shawal. Cooked and mixed dishes were rarely eaten in this snack.

TABLE 4.13

Food eaten at the afternoon snack[a]

Food Items	Shaban (n=36)		Shawal (n=29)	
	N	%	N	%
Milk	2	5.6	1	3.4
Other Milk Products	4	11.0	2	6.8
Bread	7	19.4	2	6.9
Sugar Foods	5	13.9	1	3.4
Vegetables	2	5.6	0	0.0
Fruits	19	52.8	7	24.1
Dates	2	5.6	6	20.7
Other Fruits	14	38.9	15	51.7
Juices	0	0.0	3	10.3
Sugar	11	30.6	4	13.8
Coffee	5	13.9	7	24.1
Tea	12	33.3	3	10.3
Fizzy Drinks	3	8.3	4	13.8

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

4.6.8. Evening Snack

This snack was consumed by 18.9% of respondents in three month periods. The frequency of consumption was higher in Ramadan than other non-fasting months.

The snack was eaten at home by all respondents, 37.2% shared with family and 62.8% alone.

The most popular foods eaten by at least 5% of mothers in the evening snack are presented in Table 4.14.

TABLE 4.14

Food eaten at the evening snack[a]

Food Items	Shaban (n=13)		Ramadan (n=26)		Shawal (n=4)	
	N	%	N	%	N	%
Milk	2	15.4	1	3.8	0	0.0
Leben	2	15.4	0	0.0	2	50.0
Mahalabia	0	0.0	8	30.8	0	0.0
Bread	1	7.7	2	7.7	0	0.0
Sugar Foods	0	0.0	3	11.5	0	0.0
Eggs	1	7.7	0	0.0	0	0.0
Mixed Dishes						
Sambosa with Meat	0	0.0	5	19.2	0	0.0
Jereesh	0	0.0	2	7.6	0	0.0
Hareesa with Meat	0	0.0	3	11.5	0	0.0
Macaroni with Meat	0	0.0	4	15.4	0	0.0
Other Foods						
Fruits	4	30.8	17	65.4	1	25.0
Other Fruits	0	0.0	7	26.9	3	75.0
Juices	3	23.1	4	15.4	0	0.0
Sugar	3	23.1	2	7.7	0	0.0
Tea	1	7.7	4	15.4	0	0.0
Fizzy Drinks	1	7.7	0	0.0	0	0.0

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

Fruits were more common snack foods in all months, however orange, apple and watermelons were popular in Shaban and Ramadan as well as juices, while bananas, grapes, etc. were popular in Ramadan and Shawal. Probably this difference in fruit availability between Shaban and Shawal is due to seasonal variation.

Infrequent consumption of tea and fizzy drinks was noticeable in Shaban and these beverages were never consumed in Shawal. However, more mothers had these beverages in Ramadan than previous months.

Mixed dishes, mahalabia and sugar foods were dominant in Ramadan. Some of the mixed dishes such as sambosa with meat either were bought from the market or leftovers from Fatoor, while other dishes were mostly leftovers.

Mahalabia and sugar foods were the popular sweet, and legimates (11.5%) were the preferable sugar food in Ramadan.

The overall picture that most mothers (78%) ate 3 meals a day in non-fasting months, while 96% consumed 2 meals a day in Ramadan. The difference in the mean number of food items taken was statistically significant at breakfast and lunch. Most meals were taken at home with the family and food consumed at lunch and dinner in non-fasting months was more related to that in Fatoor and Sahoor in Ramadan respectively. The meal pattern of Saudi respondents in the three month periods is shown in Table 4.15.

TABLE 4.15

Meal pattern of Saudi mothers

Meal	Shaban	Ramadan	Shawal
Breakfast	Bread, Milk/Milk Products, Egg, Tea, Sugar, Some Fruits/Fruit Juices	Nothing	Same as Shaban
Lunch (or Fatoor)	Some Bread, Leben, Mixed Dishes, Meat, Vegetables, Dates, Fruits	Leben, Mixed Dishes, Sugar Foods, Mahal-abia, Dates, Fruits/Fruit Juices	Same as Shaban
Dinner (or Sahoor)	Bread, Light Mixed Dishes, Vegetables, Fruits	Mixed Dishes, Vegetables, Sugar Foods, Mahal-abia, Fruits	Same as Shaban

The afternoon snack was the most popular one among the mothers and the foods more commonly eaten in this snack than others were tea, coffee, fizzy drinks, bread, sugar and sugar foods. However, fruits were the most common food in all three snacks and were influenced by seasonal variation. Mixed dishes and mahalabia (sweet) were more consumed at the evening snack in Ramadan than others, while cooked dishes were rarely eaten in the morning and afternoon snacks.

4.7. Food Frequency

The frequency of consumption of 32 food items was assessed by the number of times a mother included it in her diet during one month (4 weeks). For instance, a respondent who included a food item daily or 3 times a week would be attributed the value of 28 (7 x 4 weeks) or 12 (3 x 4 weeks), and a respondent including food items 1 or 2 times a week would be attributed the value of 4 (1 x 4 weeks) or 8 (2 x 4 weeks). However, on the other hand, zero or rarely eaten foods were attributed to never or once a month. This method would allow us to calculate the mean frequency of consumption of each food (Al-Meida, 1989) and the data are shown in Table 4.16.

TABLE 4.16 **Frequency of consumption of food items**

	X	Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
		N	%	N	%	N	%	N	%	
Liver										
Shaban	2.9	5	6.3	16	20.1	8	10.1	51	63.8	80
Ramadan	2.0	1	1.4	11	15.5	2	2.8	57	80.3	71
Shawal	1.6	1	1.3	11	14.5	6	7.9	58	76.3	76
Kidney										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0	0	0	0	0	0	0	71	100	71
Shawal	0.04	0	0	0	0	1	1.3	75	98.7	76
Beef										
Shaban	1.2	3	3.8	7	8.8	0	0	70	87.6	80
Ramadan	3.4	8	11.3	7	9.9	2	2.8	54	76.0	71
Shawal	1.0	1	1.3	7	9.2	1	1.3	67	88.1	76
Lamb										
Shaban	9.1	33	41.2	22	27.6	1	1.3	24	30.1	80
Ramadan	21.2	58	81.7	3	4.2	1	1.4	9	12.7	71
Shawal	12.2	39	51.3	18	23.7	0	0	19	25	76
Fish										
Shaban	0.2	1	1.3	1	1.3	0	0	78	97.5	80
Ramadan	0.01	0	0	0	0	0	0	71	100	71
Shawal	0.4	0	0	4	5.2	1	1.3	71	93.4	76

Table 4.16 (continued) . . . . .

	X	Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
		N	%	N	%	N	%	N	%	
Eggs										
Shaban	13.4	47	58.8	8	10.1	0	0	25	31.3	80
Ramadan	13.9	36	50.7	13	18.4	1	1.4	21	29.6	71
Shawal	14.6	39	51.3	21	27.7	0	0	16	21.1	76
Legumes										
Shaban	1.9	2	2.6	21	26.3	2	2.5	55	68.8	80
Ramadan	5.3	11	15.5	18	25.4	1	1.4	41	57.7	71
Shawal	2.1	2	2.6	18	23.7	2	2.6	54	71.0	76
Vegetables										
Shaban	0.14	0	0	2	2.5	0	0	78	97.6	80
Ramadan	0.5	1	1.4	1	1.4	0	0	69	97.2	71
Shawal	0.1	0	0	1	1.3	0	0	75	98.7	76
Green pepper										
Shaban	3.2	9	11.3	5	6.3	0	0	66	82.6	80
Ramadan	8.4	20	28.1	8	11.3	1	1.4	42	59.1	71
Shawal	1.8	4	5.3	4	5.3	0	0	68	89.4	76
Cabbage										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	1.6	3	4.2	9	12.7	0	0	59	83.1	71
Shawal	0.04	0	0	0	0	1	1.3	75	98.7	76

Table 4.16 (continued) . . . . .

	X	Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
		N	%	N	%	N	%	N	%	
Potato										
Shaban	5.1	16	20.1	26	32.6	1	1.3	37	46.3	80
Ramadan	11.5	31	43.7	23	32.4	1	1.4	16	22.5	71
Shawal	7.2	17	22.3	39	51.3	2	2.6	18	23.7	76
Orange										
Shaban	19.3	58	72.5	4	5.0	0	0	18	22.5	80
Ramadan	23.0	57	83.1	3	4.2	0	0	9	12.7	71
Shawal	18.9	51	67.1	12	15.8	0	0	13	17.1	76
Orange juice										
Shaban	3.8	12	15.1	4	5.1	0	0	64	80	80
Ramadan	5.3	13	18.3	2	2.8	0	0	56	78.9	71
Shawal	2.5	8	10.5	0	0	0	0	68	89.5	76
Lemon										
Shaban	10.0	29	36.3	3	3.8	0	0	48	60	80
Ramadan	20.4	52	73.2	2	2.8	0	0	17	23.9	71
Shawal	17.6	45	59.2	12	15.8	0	0	19	25	76
Lemon juice										
Shaban	0.6	2	2.6	1	1.3	0	0	77	96.3	80
Ramadan	2.4	6	8.5	1	1.4	0	0	64	90.1	71
Shawal	0.9	2	2.6	2	2.6	0	0	72	94.7	76

Table 4.16 (continued) . . . . .

	X	Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
		N	%	N	%	N	%	N	%	
Grapefruit										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0.4	1	1.4	0	0	0	0	70	98.6	71
Shawal	0.03	0	0	0	0	1	1.3	75	98.7	76
Grapefruit juice										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0	0	0	0	0	0	0	71	100	71
Shawal	0.7	2	2.6	0	0	0	0	74	97.4	76
Tomatoes										
Shaban	14.5	41	51.3	2	2.6	0	0	37	46.3	80
Ramadan	23.3	59	83.1	0	0	0	0	12	16.9	71
Shawal	21.8	59	77.6	2	2.6	0	0	15	19.7	76
Tomato juice										
Shaban	4.2	13	16.3	3	3.8	0	0	64	80	80
Ramadan	4.1	10	14.1	3	4.2	0	0	58	81.7	71
Shawal	1.4	3	3.9	4	5.2	0	0	69	90.8	76
Strawberries										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0.45	1	1.4	1	1.4	0	0	69	97.2	71
Shawal	0	0	0	0	0	0	0	76	100	76

Table 4.16 (continued) . . . . .

		Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
	X	N	%	N	%	N	%	N	%	
Dried apricots										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0.13	0	0	1	1.4	0	0	70	98.6	71
Shawal	0	0	0	0	0	0	0	76	100	76
Raisins										
Shaban	0.1	0	0	1	1.3	0	0	79	98.8	80
Ramadan	0.06	0	0	1	1.4	0	0	70	98.6	71
Shawal	0.05	0	0	1	1.3	0	0	75	98.7	76
Cows milk										
Shaban	4.9	14	17.5	0	0	1	1.3	65	81.3	80
Ramadan	4.8	12	16.9	0	0	2	2.8	57	80.3	71
Shawal	5.1	14	18.4	0	0	0	0	62	81.6	76
Goats milk										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0.4	1	1.4	0	0	0	0	70	98.6	71
Shawal	0.7	2	2.6	0	0	0	0	74	97.4	76
Camels milk										
Shaban	0	0	0	0	0	0	0	80	100	80
Ramadan	0	0	0	0	0	0	0	71	100	71
Shawal	0	0	0	0	0	0	0	76	100	76

Table 4.16 (continued) . . . . .

	X	Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
		N	%	N	%	N	%	N	%	
Evaporated milk										
Shaban	11.3	31	38.8	2	2.5	7	8.8	40	50.0	80
Ramadan	6.9	17	23.9	1	1.4	1	1.4	52	73.2	71
Shawal	9.5	25	32.9	1	1.3	4	5.3	46	60.5	76
Powdered milk										
Shaban	3.5	10	12.5	0	0	1	1.3	69	86.3	80
Ramadan	4.5	11	15.5	0	0	3	4.2	57	80.3	71
Shawal	6.3	17	22.4	0	0	0	0	59	77.6	76
Leben										
Shaban	12.9	33	41.3	7	8.8	17	21.3	23	28.8	80
Ramadan	19.2	47	66.2	2	2.8	11	15.5	11	15.5	71
Shawal	20.8	55	72.4	0	0	14	18.4	7	9.2	76
Yoghurt										
Shaban	2.8	5	6.3	4	5.0	17	21.3	54	67.5	80
Ramadan	2.2	4	5.6	2	2.8	10	14.1	55	77.5	71
Shawal	1.8	4	5.3	0	0	9	11.8	63	82.9	76
Lebeneh										
Shaban	1.3	2	2.5	2	2.5	10	12.5	66	82.5	80
Ramadan	0.2	0	0	0	0	4	5.6	67	94.4	71
Shawal	0.5	1	1.3	0	0	3	3.9	72	94.7	76

Table 4.16 (continued) . . . . .

	X	Always (daily + almost daily or 3/week)		Often (1-2/week)		Sometimes (2-3/month)		Never or Rarely (1 a month)		N
		N	%	N	%	N	%	N	%	
Cheese										
Shaban	12.2	31	38.8	5	6.3	24	30.0	20	25	80
Ramadan	9.6	20	28.2	2	2.8	35	49.3	14	19.7	71
Shawal	14.7	36	47.4	2	2.6	30	39.5	8	10.5	76

4.7.1. Meat, Meat Organs and Fish

The most popular meat in Saudi Arabia is lamb, followed by chicken and beef. Organ meat such as liver and kidney are usually eaten when a sheep is slaughtered in the house or bought from the butcher. They are consumed either fried or mixed with meat pieces, tomatoes and onions, or grilled separately.

Kidney was rarely or never consumed by almost all respondents, while 1.3% consumed it occasionally in Shawal. Liver was also never or rarely eaten by 73% of all mothers, but consumed less frequently in the three study periods and only a small proportion (6.3%) consumed it frequently in Shaban.

Beef was quite unpopular, and it was never or rarely consumed by 84% of all respondents. Interestingly, beef was eaten more in Ramadan than other months, but in small proportion (11.3% always, 9.9% often, 2.8% sometimes). This might be due to the fact that beef is less expensive than lamb in Ramadan and, in addition, it is used by some mothers for stuffing and mixing with cooked dishes.

Lamb is the most expensive meat and is preferred to veal and beef. The proportion of all respondents (23%) consuming lamb rarely or never was less than those eating lamb daily/almost daily (57%) in the three study periods. However, a higher percentage of mothers (82%) ate lamb frequently (daily/almost daily) in Ramadan than those in Shaban (41.2%) or Shawal (51.3%). Lamb is traditionally consumed with rice as Kabsa mà Laham or prepared as the main item in the stew (Maraq) with oil, tomatoes, onions, spices and one or two kinds of vegetables. The mean frequency of consumption of meat, particularly lamb ($p<0.000$) and beef ($p<0.09$) were higher in Ramadan than in non-fasting months.

Although Damman is a coastal city, fish is expensive and 97% of mothers never or rarely consumed it. Only 5.2% of respondents were eating fish weekly in Shawal and in fact this was higher than Shaban (1.3% weekly). There was no fish consumption in Ramadan among the respondents, and this may be attributed to the belief that eating fish during Ramadan may make people more thirsty; in addition, fish is expensive. Fish is cooked with rice as Kabsa mà Samak or fried in oil after seasoning.

People in Saudi Arabia preferred buying fresh meat and fish to frozen, due to the belief that the former has more nutritional value and a better taste than the latter. The quantities of meat or fish cooked depended on the economic status of the family. No significant association existed between meat consumption and mother's characteristics or socio-economic status.

4.7.2. Eggs

Eggs are traditionally eaten at breakfast and sometimes at supper. They are consumed boiled or fried with oil or mixed with onion and tomato (Shakshoka). More than a half of the respondents (53.7%) ate eggs daily or almost daily and only 27.3% never or rarely in the three study periods, while 18.5% of mothers consumed eggs less frequently (weekly). There was no significant difference in the mean frequency of egg consumption among mothers interviewed in Shaban, Ramadan and Shawal. This does not seem to agree with the picture from the 24 hour recall data, which indicates that in Ramadan, when breakfast is not eaten, egg intake is lower.

Mothers who consumed eggs more frequently were more likely to have three meals a day ($p<0.01$) and mothers who never or rarely ate eggs were less educated ($p<0.004$). This might be due to the belief that eggs are generally regarded as a hot food by some Arabians which correspondents to the trend ($p<0.06$) that more respondents were never or rarely eating eggs in summer (Shawal) than in spring (Shaban).

4.7.3. Legumes

Legumes are an inexpensive source of protein. The majority of respondents (66%) reported never or rarely consuming them. However, mothers in Ramadan (15.5%) ate more frequently (daily/almost daily) than non-fasting months.

The difference in the mean frequency of legume consumption in the three study periods was statistically significant ($p<0.01$). Mothers in Ramadan were more likely to have a higher mean frequency of legume consumption than in Shaban and Shawal. This finding corresponds with other results which showed that cooked legumes and mixed dishes (humus, foul moudamus, falafal, soups) were more eaten during the fasting month than non-fasting months. In Ramadan, traditionally soups were consumed after breaking the fast with dates. The frequency of legume consumption was associated with educational level ($p<0.004$). More mothers who consumed legumes daily/almost daily were less educated, which is probably a reflection of their socio-economic status and the good value for money which these foods represent. No association was found between frequency of legume consumption and any other maternal characteristics.

4.7.4. Milk and Milk Products

Milk and leben are popular foods that have been taken traditionally in the diet and their consumption is still quite high by the people, although cow's milk has taken over in popularity from camel's and goat's milk.

About 76% of mothers reported drinking milk. The habit of drinking goat's and camel's milk by mothers seemed to be dying out and was replaced by other types of milk. More mothers consumed evaporated milk than others (cow's milk and powdered milk), particularly in Shawal and Shaban (Table 4.16). In general the mean frequency of consumption of milk in Ramadan was lower when compared to the other months. This was particularly significant for evaporated milk. This is due to missing the breakfast meal in Ramadan when most people usually consume their milk.

Mothers consumed milk mixed with tea (41%) or plain (25%) or with American coffee (11%). Most mothers (92%) also added white sugar to their tea. Thirty-two percent added one teaspoon of sugar, others added one and a half teaspoons (24%) or two teaspoons (12%).

Milk products (cheese, leben, yogurt, lebeneh) were also consumed by 92% of respondents. Leben was more popular than other products and was drunk by more mothers, particularly in Ramadan and Shawal, probably since it is considered a cooling food. However the lower frequency of consumption of Lebeneh and cheese were noted in Ramadan than other months. Cheese is mainly consumed at breakfast and since this meal is not eaten during Ramadan cheese consumption is predictably lower. Arab cheese and creamy cheese were the most popular.

Generally, the mean frequency of consumption of milk and milk products, except for leben, were higher in Shaban and Shawal than Ramadan.

There was no significant association between milk/milk product consumption and mother's characteristics or socio-economic status.

4.7.5. Fruits and Fruit Juices

Fruits are more popular than vegetables and are usually consumed after lunch or dinner, or eaten as a snack between meals, as well as juices. In Ramadan, juices or soups with dates are often used to break the fast after sunset. The type of fruits eaten depends on the season. Melons and watermelons are available in summer and cost less than other fruits (cherries, nectarines and apricots). Citrus fruits and apples are available in winter and autumn. However, grapes and lemons are available throughout the year.

The frequency of consumption of fruits and fruit juices (fresh, frozen and canned) were more frequent in Ramadan than non-fasting months. Fresh oranges and lemons were more popular than juices. Other fruits (grapefruit, strawberries, dried apricots and raisins) and juices (tomato and grapefruit) were consumed infrequently in all months.

The mean frequency of taking all types of fruits and juices was higher in Ramadan than Shaban and Shawal except for grapefruit and tomato juices. Consumption of grapefruit juice was higher in Shawal and tomato juice was taken with similar frequency in Shawal and Shaban.

There was no significant association between frequency of consumption of fruits and fruit juices and mother's characteristics, except for orange and orange juice. Mothers who never or rarely consumed these foods were less educated ($p<0.01$) and had a large number of children ($p<0.01$), so that price is a possible explanation for this trend. This is supported by the finding that more mothers who were married to professionals and who had the ability to purchase these foods consumed them daily/almost daily.

4.7.6. Vegetables

Traditionally many different kinds of vegetables are consumed in Saudi Arabia, but their availability depends on the seasons. Vegetables like tomatoes, eggplant, onions, squash and alfalfa are more abundant in summer and inexpensive. However, they are also available in winter, but cost more. Other winter vegetables are potato, okra and carrots. Most vegetables are used in stews, kabsa or in salads. Parsley, watercress, mint and green coriander are the main green herbs used.

Of the vegetables considered, potato was the most popular, spinach and cabbage were never or rarely consumed by most mothers. However, in Ramadan consumption of cabbage as well as green pepper and potato did increase.

The mean frequency consumption of spinach, cabbage, green pepper and potatoes was significantly higher in Ramadan than in non-fasting months.

There was no significant association between mean frequency consumption of these types of vegetables and mother's characteristics and socio-economic status.

4.8. Food Practices, Beliefs and Customs in Pregnancy

From early pregnancy the Saudi mother is subject to a number of behavioral restraints. These are designed primarily to protect the fetus. In general, the woman is expected to be less active during pregnancy, particularly in the first trimester. Heavy work, fast walking and carrying heavy things over the head are believed to result in haemorrhage or miscarriage.

4.8.1. Quantity

TABLE 4.17

Beliefs about the quantity of food intake during pregnancy

Food Intake	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Yes, less	9	11.3	8	11.2	6	8.9	23	10.0
Yes, more	17	21.3	18	25.4	14	18.4	49	22.0
No, same	53	66.3	44	62.0	55	72.4	152	67.0
Don't know	1	1.3	1	1.4	1	1.3	3	1.0
TOTAL	80	100.0	71	100.0	76	100.0	227	100.0

Adequate dietary intake during pregnancy is necessary for the growth and survival of the fetus (NAC, 1970; Hytten and Chamberlain, 1980). About one-third of mothers in all three study periods believed that a woman should change the amount she ate during pregnancy.

More respondents (22%) believed that pregnant women should eat more, while 10% believed they should eat less than non-pregnant women. The reason reported by mothers (61%) for reducing dietary intake was to prevent difficulty during labour. Mothers (88%) who believed in eating more during pregnancy reported that this was in order to provide an adequate diet for themselves and their babies.

Beliefs in modifying food intake in pregnancy was influenced by educational level ($p < 0.01$). Mothers who believed they should reduce the food intake were more likely to be poorly educated, and mothers who believed that food intake should be increased were more likely to be educated to an intermediate level.

4.8.2. Food Considered Good or Bad for Pregnancy

About 77% of respondents believed in eating special foods during pregnancy (Table 4.18).

TABLE 4.18

Respondents' beliefs concerning the need for special food during pregnancy

	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Yes	69	86.0	55	77.0	52	68.0	176	77.0
No	11	14.0	16	23.0	24	32.0	51	23.0
TOTAL	80	100.0	70	100.0	76	100.0	227	100.0

$p < 0.03$

Mothers who believed in the value of special foods in pregnancy were more likely to have lower gravida (1-4) and fewer parity (1-4). They were also characterized as middle educated, worked inside and outside the home and have highly educated husbands with good jobs (professionals). Mothers who attended in Shaban were more likely to believe that special foods were necessary and this is probably due to the higher level of attendance of first time mothers during this period.

Foods consumed were believed to be nutritious, protected mother and baby's health and benefitted baby's growth, as shown in Table 4.19. Only 11% of mothers did not know the reasons behind the consumption of these foods.

TABLE 4.19

Reasons for food advised in pregnancy[a]

Reason	N (176)	%
Nutritious	142	80.7
Increase mother's blood	138	78.4
Protect mother's health	72	41.0
Protect baby's health	123	70.0
Good for baby's growth	57	32.0
Don't know	20	11.0

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer

Traditionally, during the first trimester of pregnancy the expectant mother may feel weak and nauseous, and needs to be relaxed and rested. Then, as the pregnancy progresses towards the second and third trimesters, the mother feels hot (hur) and cooling foods such as fruits and vegetables are preferred to reduce the body heat. Very cold foods were proscribed and mothers advised to avoid draughts and winds in order to avoid stomach pain, gas and indigestion.

In line with tradition, in this study fruits and vegetables were indeed the foods most commonly cited as beneficial during pregnancy. However, the high level of recommendation of milk, eggs and meat would tend to support the view that some mothers have also been influenced by western ideas of appropriate diets for pregnancy. This would seem to be consistent with the association between beliefs about special foods and the level of mother's education previously noted (Table 4.20).

TABLE 4.20

Food items advised in pregnancy[a]

Food Items	N (176)	%
Fruits	127	72.0
Vegetables	110	62.5
Milk	96	54.5
Leben	48	27.4
Cheese	18	10.2
Eggs	57	32.4
Meat (hot) (lamb & beef)	55	31.3
Chicken (cool)	12	6.8
Fish	6	3.4
Liver	15	8.5
Rice	3	1.7

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

The majority (61%) of respondents also reported that certain foods should be avoided during pregnancy (Table 4.21).

TABLE 4.21

Food avoidance beliefs during pregnancy

	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Yes	53	66.0	37	52.0	48	63.0	138	61.0
No	27	34.0	34	48.0	28	37.0	89	39.0
TOTAL	80	100.0	70	100.0	76	100.0	227	100.0

$P<0.02$

These foods are presented in Table 4.22.

TABLE 4.22

Food avoidance in pregnancy[a]

Foods avoided	N (138)	%
Spicy food	54	39
Food rich in fat and oil	45	33
Sweet foods	37	27
Beverages (tea, coffee, soft drinks)	26	19
Sour foods	22	16
Starchy foods	18	13

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

The reasons for not consuming these foods are indicated in Table 4.23.

TABLE 4.23

Reasons for food avoidance during pregnancy[a]

Reasons for avoiding foods	N (138)	%
Heartburn	70	51
Increase mother's weight	65	47
Bad for baby	26	19
Cause gases	26	19
Don't know	14	10

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

Spicy (hot pepper) and sour (vinegar, citrus fruits) foods were mostly avoided to prevent heartburn and indigestion. In addition, spicy foods taken during the last two trimesters were believed to be bad for the baby and may cause baldness.

Other foods avoided were starch (rice), sweet and fatty foods which were mostly believed to increase the mother's and baby's weights and cause difficulty in labour; while beverages (tea, coffee and soft drinks) were avoided because they were believed to cause tiredness and headache. Most respondents had no explanation for their belief that pregnant women should avoid salty foods, although a few reported that it would increase the mother's weight.

Mothers who believed in food avoidance were more likely to be housewives who also worked outside the home, middle educated and having highly educated husbands with professional jobs. However, these mothers with beliefs in food avoidance during pregnancy might not practice what they preach. Another possibility is that these educated mothers still kept and practised what they learned from their family.

The overall picture of food preference and avoidance during pregnancy by Saudi respondents carried traces of the hot/cold system such as fruits and vegetables as cooling desirable foods, while pepper, vinegar, coffee and salt as hot and undesirable proscribed foods. In addition, these prescribed and proscribed foods were also related to Western ideas of nutrition.

4.8.3. Food Craving and Aversion

TABLE 4.24

Food craving during pregnancy

Food craving	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Yes	34	42	18	25	20	26	72	32
No	46	58	53	75	56	74	155	68
TOTAL	80	100	71	100	76	100	227	100

Craving and aversion are powerful urges toward or away from food. Thirty-two percent of mothers reported craving for one or two kinds of food items during pregnancy, and 68% never craved for any food. Most craving is likely to occur in the first trimester (58%) than the others (2nd, 34%; 3rd, 8%). The most commonly reported craved food types amongst respondents (65 cases) were vegetables and fruits (53, 81.5%) and cooked dishes (23, 35.4%). Both food groups were more craved during Shaban than the other two months, but the differences were not statistically significant. The most common food items craved are shown in Table 4.25.

TABLE 4.25

Common food items craved by mothers during pregnancy[a]

Food items	N (72)	%
Cucumber	3	4.2
Pickle	3	4.2
Hot green pepper	3	4.2
Pomegranate	3	4.2
Lime	3	4.2
Lemon	12	16.7
Mango	3	4.2
Melon	4	5.6
All fruits	2	2.8
Liver	2	2.8
Fish	3	4.2
Hareesa	2	2.8
Malokhia	2	2.8
Salty foods	2	2.8
Other foods	37	51.4

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

A substantial proportion of mothers (41%) believed that an unsatisfied craving would lead to a birth mark on the baby's skin which would mimic the shape of the desired food.

A trend in food craving was found to be related to stage of pregnancy, gravida, parity and number of living children. More mothers who had food cravings were in the first trimester, had lower gravida and parity (1-4) and fewer children (1-4). Their husbands were middle educated and worked as clerks. They also consumed one snack (43%) as compared to 27% who never snacked, and had higher caloric intake (57%) than mothers who never craved (43%).

Differences in food craving between the three months was statistically significant ($p < 0.04$). More food cravings were found among respondents who were interviewed in Shaban (42%) than the other two months (Ramadan 25%; Shawal, 26%) because there were more mothers in the first trimester of pregnancy.

Regarding aversions, about 46% of mothers experienced an urge away from different kinds of food, and 54% had no aversions, as shown in Table 4.26.

TABLE 4.26

Food aversion beliefs during pregnancy

Food aversion	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Yes	37	46	33	46	35	46	105	46
No	43	54	38	54	41	54	122	54
TOTAL	80	100	71	100	76	100	227	100

The food groups most commonly associated with aversions (91 cases) were meat and fish (84, 92.3%), rice and bread (28, 30.8%), milk and eggs (17, 18.7%) and fruit and vegetables (15, 16.5%). It seemed that the majority of mothers disliked meat and fish and a minority fruits and vegetables. This finding corresponds with other studies (Payton *et al.*, 1960; Hook, 1978; Worthington-Roberts *et al.*, 1985), which have shown that meat was the food most commonly identified with aversion, as seen in Table 4.27.

No significant difference in food group aversions was found among the three month periods. The food items most commonly cited as aversions are shown in Table 4.27.

TABLE 4.27

Common food items disliked by mothers during pregnancy[a]

Food items	N (105)	%
Meat	51	48.6*
Chicken	17	16.2
Fish	8	7.6
Eggs	6	5.7
Milk	8	7.6
Rice (white)	26	24.8
Kabsa	7	6.7
Food smell	8	6.7
Tea	5	4.8
Vegetables (onion, cucumber, eggplant, salad)	7	6.7
Fruits (tomato, apple, orange, watermelon, figs, fruit juices)	9	8.6

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

The reasons behind food aversions are shown in Table 4.28.

TABLE 4.28

Reasons for food aversions[a]

Reasons for food aversion	N (103)	%
Nausea and vomiting	67	65.0
Bad smell	53	51.5
Bad smell and nausea	35	34.0
Heartburn	5	4.9

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

"Nausea and vomiting" was the main reason for avoiding fruits and vegetables, milk and eggs, and rice and bread. However, both "nausea and vomiting" and "bad smell" were similarly associated with aversion to meat and fish. No significant difference was found between food craving or food aversion beliefs and the three month periods. However, a trend in food aversion was related to gravida, parity and number of living children. Mothers who stopped eating those foods were more likely to be associated with morning sickness, had lower gravida and parity (1-4), and less number of living children (1-4). In addition, a trend towards lower total calories and protein intakes was noted among mothers who reported experiencing food aversions.

4.8.4. Pica in Pregnancy

TABLE 4.29

Prevalence of pica in pregnancy

Prevalence of pica	**Shaban** N	%	**Ramadan** N	%	**Shawal** N	%	**Total** N	%
No pica	76	95	62	87	73	96	211	93
Pica	4	5	9	13	3	4	16	7
TOTAL	80	100	71	100	76	100	277	100

Pica, the eating of non-food substances, a practice considered by some researchers to be a form of craving having mostly cultural origins. In this study, seven percent of mothers craved for green mud (6.6%) and soap (0.4%). Green mud is a non-food substance collected from the depths of wells and dried under the sun and then sold at the markets. The scientific implications of pica are not well understood. Some pica (mud and clay) may cause a deficiency of some minerals by binding them (Lackey, 1982). Low dietary intakes of calcium and iron were found in the mothers who ate green mud. Chemical analyses of green mud provide indications that the consumption supplies nutrients in appreciable amounts, particularly magnesium and iron, as shown in Table 4.30.

TABLE 4.30

Green mud contents

Element	Amount	%
Magnesium (Mg)	60.33 mg/g	6.033
Iron (Fe)	48.75 mg/g	4.875
Calcium (Ca)	4.65 mg/g	0.465
Zinc (Zn)	93.5 ug/g	0.0935
Copper (Cu)	30 ug/g	0.03

Mothers with pica tended to eat less frequently (67% had a trend of eating two meals a day, and 6% had one snack). They are also more likely to live in rented homes, which means that these mothers came from a low socio-economic background. Mud consumption was significantly ($p<0.04$) higher in mothers with poor education (Table 4.31).

TABLE 4.31

Pica and educational level

Educational level	No Pica		Pica		Total	
	N	%	N	%	N	%
Low	73	35	10	67	83	37
Middle	94	44	4	27	98	43
High	44	21	1	8	45	20
TOTAL	211	100	15	100	226	100

Craving green mud by mothers (13%) reached its peak during Ramadan. However, consumption during non-fasting (Shaban and Shawal) study periods was similar. This could be explained by the fact that fasting may increase the needs for minerals. About 80% and 40% of mothers with craving for green mud had low iron and calcium intakes.

4.8.5. Morning Sickness

TABLE 4.32

Nausea and vomiting during pregnancy

Nausea and vomiting (times per week)	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
No nausea and vomiting	59	74	45	63	44	58	148	65
1-7	9	11	21	30	15	20	45	20
14-35	12	15	5	7	17	22	34	15
TOTAL	80	100	71	100	76	100	227	100

"Nausea and vomiting" (N/V) is regarded as one of the discomforts that accompanies pregnancy and about 35% suffered from it in the study. As can be observed in Table 4.32, a substantial number of mothers (45, 20%) had 1-7 times of N/V per week, while others (34, 15%) suffered 14-35 times per week, the total average being 4.8 ± 8 of those who had N/V.

Mothers who suffered the higher frequency of N/V (14-35 times/week) tended to be in the age of 20-30 years and had experienced 1-4 pregnancies. It has been noted that mothers who experienced severe N/V during pregnancy had a reduced nutrient intake (Beal, 1980; Worthington-Roberts, 1985). This fact was found to be true to some extent in the present study. Mothers with a higher frequency of N/V had lower energy ($p<0.01$) and vitamin B_6 ($p<0.05$) intakes. These deficiencies can be attributed to a decreased number of meals eaten during the day ($p<0.04$) and the decrease in number of items consumed at meals, particularly lunch ($p<0.02$) and dinner ($p<0.01$), which were influenced by severe N/V. Aggravation of these symptoms during the first trimester may lead to eating the incorrect type of diet, in a addition to food loss due to vomiting.

A significant difference ($p<0.01$) existed between Shaban, Ramadan and Shawal regarding the mothers with N/V. The mean frequency of suffering from N/V (6.0 ± 9.4) of mothers who were interviewed in Ramadan was higher than other months. More mothers (81%) in Ramadan had mild N/V as compared to 43% and 47% in Shaban and Shawal respectively. This may be due to the present odours of the rich food prepared at that time.

Other complaints during pregnancy were constipation (0.4%), heartburn (5.3%), headache (8.8%) and back and joint aches (3.5%).

4.9. <u>Summary</u>

Pregnancy in Saudi Arabia is still governed by rules that stem from culture and tradition which are transmitted from one generation to another. These cultures and beliefs influence a woman's life concerning food ways and meal patterns. Food available in the household was mostly supplied by the husband and the respondents usually planned, prepared and cooked the meals. In most cases the main meals were cooked fresh and often eaten at home with family members eating from one dish by using hands. There were three main meals in the non-fasting months and only two main meals in Ramadan. Mothers in Shawal included more food items at breakfast than in Shaban, however mothers who were interviewed in Ramadan included more food items at Fatoor, than was usual at lunch in non-fasting months.

A third of respondents claimed to have one or more snacks during the day and these were mostly eaten at mid-afternoon. The most common snack foods were fruit/fruit juices, milk/milk products, tea, coffee, sugar and bread in non-fasting months, while fruits/fruit juices, mixed dishes and mahalabia in fasting months (at evening snack).

Beliefs and attitudes concerning diet in pregnancy were found among Saudi women which aimed to maintain the health of the mother and her baby. Dietary prescription and restriction carried traces of hot/cold concept and some attachment to western ideas concerning nutritional food groups. Fruits and vegetables were considered cooling foods and spicy, oily and sweet foods were heating foods.

Cravings and aversions were widely practised by these pregnant women, especially in the first trimester. Fruits and vegetables were the foods which were mainly craved and lemon was the most common food item. Unsatisfied cravings would leave a birth mark on the baby's skin, according to 41% of mothers.

Aversion was experienced by 46% of mothers and mostly towards meat, fish, rice and bread. Causes of aversion were "nausea and vomiting" and "bad smell" from food. Nutritionally, cravings are for foods that provide vitamins C and A, while aversions limit the intake of animal protein and energy.

Cravings for non-food substances (pica) was practised by a small proportion of mothers (7%), who mainly ate green mud, which contained measurable amounts of magnesium, iron and calcium. This habit was found among more mothers in Ramadan that other months, and most of these women had lower dietary intakes of iron and calcium. Pica was found to be inversely related to educational level. The relationship between meal patterns and nutrient intakes will be considered in Chapter V.

CHAPTER V

NUTRITIONAL INTAKE, ANTHROPOMETRIC AND CLINICAL INDICATORS DURING PREGNANCY

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5.1. Food Consumption

The 24-hour dietary recall and food frequency are important tools to obtain information on the meal structure, composition of diet and food habits. The primary objective of the section was to assess the quality of the major foods consumed and also to provide a general description of adequacy of energy and nutrient intake of pregnant women as compared to FAO/WHO recommended levels (1974; 1985).

As discussed previously, the analysis of food contents consumed during a 24-hour period was estimated by using compositional data from British, Middle Eastern and Bahraini food tables. The quantification of food intake by respondents was probably underestimated. A high proportion of them ate mixed dishes whose ingredients tend to be variable, particular in the main meals. In addition, data in the Bahraini and Middle Eastern tables is mostly extracted from other tables of food composition or literature (Pellett and Shadarevian, 1970; Musaiger and Al-Dallal, 1985). These tables do not include all dishes, and in some instances it was necessary to estimate energy and nutrient content based on the analysis of the raw foods. This leads to error in the estimate of intake, in particular difficulty in quantifying fat and oil would increase the error in energy and nutrient intake estimated from 24 hour dietary recall. Therefore, a general description of adequacy of intake based on FAO/WHO recommendations will be discussed.

5.1.1. Energy and Nutrient Intake Adequacy

It is generally accepted that nutrient requirements are increased during pregnancy. The needs for energy, protein and other nutrients have been assessed by FAO/WHO in 1974. However, the requirements for energy and protein were revised in 1985. Estimations of energy and other nutrients during pregnancy are based on the requirements of a reference woman (a non-pregnant, non-lactating healthy woman, aged 29-39 years, with a body weight of 55 kg who is moderately active). Then the costs of pregnancy are added to these needs. Some studies in pregnancy have shown that mothers from the high income group did not raise their energy and protein intake as pregnancy advanced (Beal, 1971; Whitehead *et al.*, 1984). The results of a Cambridge study on 25 pregnant mothers showed that at an energy intake of 2,200 kcal in pregnancy the mean birth weight was 3.3 kg (Whitehead *et al.*, 1984). This revealed that the recommended energy intake for women in Britain (2,400 kcal/day) was very high.

The requirement for protein was 38 g/day in 1974, and then it was reduced to 35 g/day in 1985, which is very low as compared to developed countries.

There is little data on the effect of low vitamin and mineral intakes during pregnancy, except for anaemia. Research has shown that healthy, well-nourished mothers can meet the cost of pregnancy without increasing their dietary intake; however, this might not be true for women in the developing countries, particularly those from low income groups who do not start their pregnancy with optimal nutritional status and have large responsibilities towards family and work. Therefore women in this study are judged to be probably at risk if their energy and nutrient intake are below FAO/WHO international recommended intakes for developing countries. This data is presented in Table 5.1.

5.1.2. Energy Intake

The majority of respondents (96%) had lower energy intake than FAO/WHO recommended level (2,400 kcal/day) and only 4% met that level. The total mean intake by the respondents was 1,260 ± 594 kcal/day, which is slightly higher than half of the recommended level. Mothers with a high energy intake were more likely to have fewer children (1-4) and a higher number of meals. The latter was found to provide a higher percentage of calories from protein ($p<0.0001$), fat ($p<0.01$) and

TABLE 5.1 Energy and nutrient intake of pregnant women

	Intake < Standard						Intake ≥ Standard						Mean Intake ± SD			S.S.
	Shaban		Ramadan		Shawal		Shaban		Ramadan		Shawal		Shaban	Ramadan	Shawal	
	N	%	N	%	N	%	N	%	N	%	N	%				
Energy (kcal/d)	(76)	95	(71)	100	(70)	92	(4)	5	(0)	0	(6)	8	(1404±616)	(1035±509)	(1319±589)	S
Protein (g/d)	(16)	20	(32)	45	(13)	17	(64)	80	(39)	55	(63)	83	(65±35)	(40±28)	(72±45)	S
Fat (g/d)	(64)	80	(66)	93	(63)	83	(16)	20	(5)	7	(13)	17	(54±31)	(36±24)	(53±29)	S
Carbohydrate (g/d)	(80)	100	(71)	100	(76)	100	(0)	0	(0)	0	(0)	0	(142±64)	(131.7±62)	(122.9±57)	NS
Niacin (mg/d)	(48)	60	(47)	66	(46)	60	(32)	40	(24)	34	(30)	40	(15±11)	(13±9)	(16±9)	NS
Thiamin (mg/d)	(74)	92	(71)	100	(74)	97	(6)	8	(0)	0	(2)	3	(0.6±0.3)	(0.45±0.2)	(0.5±0.2)	S
Riboflavin (mg/d)	(11)	24	(5)	62	(11)	31	(35)	76	(3)	38	(24)	67	(1.6±1.5)	(0.6±0.4)	(1.2±1.0)	S
Vitamin C (mg/d)	(27)	35	(21)	31	(25)	36	(50)	65	(47)	69	(45)	64	(85±70)	(96±86)	(65+52)	S
Vitamin B_{12} (ug/d)	(67)	84	(68)	96	(65)	86	(13)	16	(3)	4	(11)	15	(3.3±6)	(1.4±3)	(2.7±6)	S
Vitamin B_6 (mg/d)	(100)	100	(100)	100	(100)	100	(0)	0	(0)	0	(0)	0	(0.4±0.3)	(0.34±0.3)	(0.31±0.3)	NS
Vitamin A (ug/d)	(61)	76	(64)	90	(67)	87	(19)	24	(7)	10	(10)	13	(500±495)	(356±381)	(400±402)	NS
Calcium (mg/d)	(43)	54	(60)	84	(33)	43	(37)	46	(11)	16	(43)	57	(1022±626)	(609±382)	(1294±873)	S
Iron (mg/d)	(62)	78	(59)	83	(62)	82	(18)	22	(12)	17	(14)	18	(10±7)	(9±8)	(11±10)	NS
Fibre (g/d)	(80)	100	(71)	100	(76)	100	(0)	0	(0)	0	(0)	0	(5±3)	(5±3)	(4+3)	S

carbohydrate ($p < 0.0000$). However, no significant difference was found between the different sources of energy.

Stage of pregnancy was not significantly associated with energy intake. But there was a significant variation ($P < 0.05$) in the mean energy intake in the three study periods (see Table 5.1A in Appendix V). The total mean energy intake of mothers during Ramadan was lower than other means during Shaban and Shawal, as Table 5.1 shows. This could be explained by the fact that the number of meals in Ramadan was lower than in non-fasting months, with less amounts eaten from foods high in energy. In addition, more juices and fluids were drunk, particularly following breakfasting which occupies a large place in the stomach volume.

Another explanation for low calorie consumption may also be due to the limited activities which these mothers carried at home, particularly in Ramadan, and to the probable adaptability towards low food consumption. As regards Shawal, mothers had not returned to normal food habits, as they were before fasting.

This finding did not correspond with results from another study carried out in Saudi Arabia. Frost and Pirani (1987) reported that fasting people (men + women) tended to have higher mean energy intake during Ramadan (3,680 ± 1,260 kcal/day) than after Ramadan (2,425 ± 850 kcal/day). They attributed this to the fact that the meals during Ramadan are nutritionally more dense than those consumed during non-fasting months. However, Sadek (1960) found that fasting limited pregnant mothers' average intake to 1,690 calories as compared to an average intake of 2,130 calories among the non-fasting mothers.

5.1.3. <u>Protein Intake</u>

According to the FAO/WHO recommended dietary intake (35 g/day), 73% of all mothers had adequate protein intake during pregnancy, while 27% had lower intake. The total average of protein intake being 59 ± 38 g/day. Protein intake tended to decrease when mothers had more children and in the later stages of pregnancy, but this was not statistically significant.

Mothers who were interviewed in Ramadan had a significantly lower mean protein intake when compared to the mean intakes in other non-fasting months (Table 5.1, 5.2A in Appendix V) and protein also provided a significantly smaller proportion of calories (Table 5.2).

TABLE 5.2

Percentage contribution of protein to energy consumption in the three study periods

	Mean % of kcal from protein (Mean ± SD)
Shaban	20 ± 2
Ramadan	15 ± 8
Shawal	22 ± 12
Mean ± SD	19 ± 13

$p < 0.01$

This result does not correspond with other research findings for men and non-pregnant women. Frost and Pirani (1987) found that the average protein intake during Ramadan (109 ± 35) was higher than after (89 ± 27). However, Sadek (1960) stated that fasting had limited pregnant mothers' intakes from protein to 54.4 g/day compared to an average intake of 76.6 g/day protein among the non-fasting mothers. This could be explained by the fact that mothers in Ramadan had only two main meals per day and a positive association had been found between the number of meals and the protein intake ($p < 0.000$). In addition, a lower consumption of meat/meat products, eggs and milk/milk products was found in Ramadan than other months.

5.1.4. Fat Intake

The fat intake of the majority of respondents (85%) was lower than the recommended level and a small proportion (15%) had fat intakes greater than 30% energy.

A higher number of meals ($p<0.000$) and snacks ($p<0.01$) were associated with a higher fat intake. Fat intake during Ramadan was also significantly lower ($p<0.002$) (Table 5.3A in Appendix V) than the other months and provided a smaller proportion of energy ($p<0.01$) (Table 5.3). Again, this could be attributed to fewer meals and also there may have been an underestimation in the quantity of fat and oil consumed in all three study periods. In contrast, Frost and Pirani (1987) found that people tended to consumer higher fat during Ramadan than after, due to the higher consumption of oil, Arabic sweets and other foods rich in oil, such as Sambosa with meat and vegetables.

TABLE 5.3

Percentage contribution of fat to energy consumption during the three study periods

	Mean % of kcal from fat (Mean ± SD)
Shaban	33 ± 10
Ramadan	30 ± 11
Shawal	35 ± 10
Mean ± SD	33 ± 10

5.1.5. Carbohydrate Intake

Carbohydrate intake of respondents was lower than the recommended level. About 59% of them consumed two-thirds or more of that level, and 41% consumed less than one-third. The total average mean of carbohydrate intake was 133 ± 61.

Mothers with higher carbohydrate consumption than two-thirds of the recommended level were more likely to be in the first trimester and have more children.

The contribution of carbohydrate intake to energy supply in the different three month periods can be observed in Table 5.4.

TABLE 5.4

Percentage contribution of carbohydrate to energy consumption during the three month periods

	Mean % kcal from carbohydrate (Mean ± SD)
Shaban	39 ± 12
Ramadan	50 ± 13
Shawal	37 ± 12
Mean ± SD	42 ± 14

It seemed that the main source of energy in Ramadan was carbohydrate and the mean percentage of energy contributed by it was higher in that month than in non-fasting months ($p<0.000$).

There was no significant variation in the mean carbohydrate intake regarding three month periods. However, when Shaban is compared with Shawal, the latter had the lowest mean intake of carbohydrate. This result corresponds with Frost and Pirani's finding (1987) that carbohydrate consumption after Ramadan was lower than before and this might be attributed to a difference in the number of snacks ($p<0.02$) and in addition to unusual food habits after Ramadan.

5.1.6. Niacin Intake

The majority of respondents (62%) had inadequate niacin intake and only a small proportion (38%) met FAO/WHO recommended levels (16.8 mg/day). The total mean being 14.6 ± 10.

Mothers with higher niacin intake were more likely to have lower gravida, parity and number of living children.

In addition, a trend with husband's work was found. More mothers who met the recommended level of niacin intake were married to professionals. This might indicate that this group of mothers enjoyed a higher income which enabled them to buy more food high in niacin, such as meat.

There was no significant difference in mean niacin intake between the three month periods. However, mean niacin intake in Ramadan was slightly lower than those in other months, which was due to lower consumption of foods rich in niacin, such as meat and meat products.

5.1.7. Thiamin Intake

Thiamin intake of the majority of mothers (96%) was lower than FAO/WHO recommended intake (1.0 mg/day). Only 4% had met that level. The total average of thiamin intake was 0.53 ± 0.3.

Mothers with adequate thiamin intake were more likely to have three meals a day ($p<0.02$). There was no significant association between this variable and mother characteristics of socio-economic status, but it was statistically different in the three study periods ($p<0.04$). Mothers who were interviewed in Ramadan had lower mean intakes as compared to Shaban and Shawal. This can be attributed to lower consumption of food rich in thiamin, such as wheat grain and enriched cereals. In addition, most respondents, particularly in non-fasting months, consumed more white bread and rice. Washing and overcooking may increase the loss of this vitamin.

5.1.8. Riboflavin Intake

The majority of mothers (70%) had adequate intake of riboflavin as compared with FAO/WHO recommended levels (1.5 mg/day). Only 30% did not meet that level.

A higher number of meals was found to be related to riboflavin intake ($p<0.03$). Mothers with a higher consumption of this vitamin were more likely to have 3 meals a day. However, this intake was not influenced by the number of snacks or other variables. The difference in mean riboflavin intake in the three month periods was statistically significant ($p<0.000$).

Mothers who were interviewed in Ramadan had a lower mean intake of this vitamin than mothers who were interviewed in the non-fasting months. The failure of the diet consumed by the respondents to supply adequate amounts of riboflavin is due to the low intake or consumption of animal products, which are usually rich in this vitamin.

5.1.9. Vitamin C Intake

Vitamin C intake of the majority of the mothers (66%) met FAO/WHO recommendations (50 mg/day), the total mean intake being 81.7 ± 71, and this exceeded the WHO level. About 34% had an inadequate intake of this vitamin.

Mothers with adequate levels of vitamin C were more likely to be in the first trimester and this contributed to a high craving towards fruits.

There was no significant association between this vitamin and the number of meals or snacks. However, mother's education ($p<0.004$), husband's education ($p<0.001$) and mother working ($p<0.04$) were found to be highly related to vitamin C intake. More mothers with higher intake of this vitamin were more likely to be highly educated, working outside home and have professional husbands.

The mean vitamin C intake was significantly different in the three study periods ($p<0.03$), and it was higher in Ramadan than Shaban and Shawal. This might be due to the higher consumption of fruits and juices in the fasting months than others.

Although vitamin C intake was found to be relatively adequate for most respondents, the calculation of the intake was mainly based on the composition of nutrients present in the foods. No account was taken of the effects of cooking methods, and vitamin C is one of the vitamins easily destroyed by heat. Although some vegetables are eaten fresh, the habit of boiling soup or stewing vegetables for extended periods is also common among the Saudi mothers. These habits could result in the low preservation of vitamin C in the diet.

5.1.10. Vitamin B_{12} Intake

The vitamin B_{12} of the majority of respondents (88%) was lower than the recommended level (3 ug/day). A small proportion (12%) had inadequate intake of vitamin B_{12}.

Mothers with higher intakes of this vitamin tended to be in the first trimester and had a lower number of miscarriages ($p<0.02$). There was no significant association of this vitamin and number of meals or snacks consumed. However, there was a trend for B_{12} intakes to be lower during Ramadan ($p<0.07$) and this could be due to lower consumption of milk/milk products, eggs and meat.

5.1.11. Vitamin B_6 Intake

The intake of vitamin B_6 of the majority of mothers (90%) was less than one-third of the RDA of the United States (2.6 mg/day). Only 10% had an intake of more than one-third. The intakes of this vitamin were inadequate among all mothers.

A trend in vitamin B_6 intake was related to gravida, parity and number of living children. More mothers who consumed more than one-third the RDA were more likely to have lower gravida, parity and number of living children. These mothers (56%) had their vitamin B_6 provided from three meals and 44% from two meals. No significant association was found between vitamin B_6 intake in the three study periods or with the number of snacks or socio-economic status.

5.1.12. <u>Vitamin A Intake</u>

According to FAO/WHO recommended level (750 ug/day), 16% of respondents met that level of vitamin A intake and 84% had an inadequate intake. The total average of vitamin A intake was 422 ± 434 and this was lower than the recommended level. Mothers with higher intake of this vitamin were more likely to be highly educated, have less parity and lower number of living children.

The difference in mean vitamin A intake in the three month periods was not significant. However, mean intake of this vitamin in Ramadan was slightly lower than that in non-fasting months, particularly in Shaban, but it did not reach a significant level. This might indicate that mothers who were interviewed during Ramadan consumed less vegetables, liver, milk/milk products and eggs, which are the best sources for vitamin A, than other mothers who were interviewed during Shaban and Shawal and fruits were mostly the main source for this vitamin.

5.1.13. <u>Iron Intake</u>

About 81% of respondents had an iron intake less than the FAO/WHO recommended level (14.28 mg/day) and 19% met that level. The total average of iron intake was 10.3 ± 8.6.

A trend in iron intake was found to be related to the stage of pregnancy, parity and number of living children and miscarriages. Mothers who met the recommended level were more likely to be in the first trimester, have less parity and lower number of living children and miscarriages. However, no association existed between iron intake and Hb or Hct levels.

Iron intake was found to be associated significantly with mother's educational level ($p<0.02$), mother's work ($p<0.01$) and father's work ($p<0.05$). More mothers with higher intake of iron tended to be highly educated, working outside the home and have husbands with professional jobs.

There was no significant difference in the mean iron intake in the three study periods. However, the mean intake in Ramadan was slightly lower than in the non-fasting months, which might be due to lower consumption of meat and meat products, vegetables and eggs. In addition, some Saudi families consumed more meats and meat products during the first few days in Shawal because of the celebration of Eid Al-Fitre.

5.1.14. Calcium Intake

The majority of respondents had calcium intakes (60%) below the recommended level (1000 mg/day) and 40% had an adequate intake.

Mothers who had higher intakes of calcium were more likely to be in the first trimester, have lower parity, fewer children and less number of miscarriages. They also tended to have three meals ($p<0.000$) and snack a day. No significant association was found between calcium intake and other mother characteristics or socio-economic status. However, the difference ($p<0.000$) in the mean calcium intake in the three study periods was statistically significant. The mean intake of this mineral was lower in Ramadan than other means in Shawal and Shaban. This could be due to a decrease in consumption of milk and milk products in Ramadan, which are usually considered a main item at breakfast. Also, it was noted that the mean intake of calcium during Shaban was lower than that in Shawal. This might be attributed to the same reason.

5.1.15. Fibre Intake

The majority of mothers (92%) had fibre intake less than half the usual intake of British people (20 gm/day) and only 8% had more than half of that level. The total mean of fibre intake was 4.6 ± 3.0.

A higher number of meals was not found to provide a higher fibre intake, but the number of snacks was associated with more fibre intake ($p<0.001$). This was because fruits were the most popular snacks.

There was no significant association between fibre intake and mother's characteristics or socio-economic status. However, the difference in mean fibre intake was statistically significant ($p<0.03$) in the three study periods. Mean fibre intake in Shawal was lower than other means in Shaban and Shawal.

5.2. Factors Influencing Nutrient Intakes

5.2.1. Relationship between Nutrient Intake and Socio-Economic Status

It has been recognized that socio-economic status of the mother may influence the adequacy of nutrient intake and consequently the course of pregnancy and the development of the fetus (WHO 1965; Bissenden *et al.*, 1981a). For instance, family size may affect the mother's dietary needs on account of the additional time needed to take care of her children, cooking, cleaning and perhaps work outside the home. In this study, Saudi mothers with fewer children were more likely to have adequate intakes of energy, niacin, iron and calcium, while mothers with more children tended to have low intakes of protein and vitamin B_6.

Boyd Orr (1936) reported in his study that income influenced food choice, both the amount spent on food and the types of food purchased. In addition, educational level is also an important factor which interferes with income to influence food habits. Most of the highly educated mothers enjoy a good economic status, and this may explain the differences in the intake of the expensive foods (meats and fruits). In this study, educated mothers were more likely to have high intakes of niacin, iron and vitamin C. A similar pattern was found among mothers who were married to professional and educated husbands. However, a high fat intake was associated with poor education. In Bahrain, Musaiger (1977) found that highly educated mothers during pregnancy had better food habits and consumed foods with higher nutritive value than other educational level groups. And, there was a general trend to consume a low amount of nutrients among poorly educated and low income pregnant mothers (Hunt *et al.*, 1976). Similar findings were reported in Iraq (Demarchi *et al.*, 1966) among pregnant mothers of low socio-economic status. These mothers did not consume adequate quantities of milk, eggs, meats, fruits and vegetables, so that the intake of protein, minerals (Ca, Iron) and vitamins (A and C) was below the recommended daily allowance (Demarchi *et al.*, 1966).

5.2.2. Meal Patterns

Some dietary intake was found to be related to the meal and snack frequencies. High intake of energy, protein, fat, vitamins (thiamin and riboflavin) and calcium were provided by higher number of meals. While fibre and carbohydrate was associated with more snacks, and this was mainly due to high fruit consumption.

5.2.3. Stage of Pregnancy

On the other hand, some nutrient intakes were associated with stage of pregnancy. More mothers had high intakes of carbohydrate, calcium, iron and vitamins (B_{12}, C) in the first trimester, while low protein intake in later pregnancy. However, there was no variation in energy intake among trimesters.

5.2.4. Ramadan

However, total energy and percentage of energy derived from protein and fat, in addition to protein, fat, vitamins (thiamin, riboflavin, B_{12}) and calcium were lower in Ramadan than other months. This might be due to a lower number of meals, absence of breakfast and reduced activity during Ramadan. While high intakes of carbohydrate and vitamin C in that month could be related to high consumption of fruits and potatoes which were frequently consumed in summer (Ramadan) than Spring (Shaban) due to low prices. But when Shawal added to Ramadan as summer season, there was no significant difference in consumption of these foods.

5.3. Anthropometric Findings

5.3.1. Weight at First Antenatal Clinic

TABLE 5.5

Mother's weight at first antenatal clinic

Trimester (weeks)	Shaban			Ramadan			Shawal			Total		
	N	%	Mean (kg)	N	%	Mean (kg)	N	%	Mean (kg)	N	%	Mean (kg)
1 (<13)	48	66	65	34	48	62	41	54	60	62	123	56
2 (13-24)	17	23	69	27	38	65	29	38	65	66	73	33
3 (≥25)	8	11	67	10	14	69	6	8	69	69	24	11
Mean ± SD	66 ± 13			64 ± 13			62 ± 13			64 ± 13		
TOTAL	73	100		71	100		76	100		220	100	

Most mothers (56%) in the sample were in the first stage of pregnancy (< 13 weeks) and the average mother's weight was 62 kg. However, 33% and 11% of mothers fell in the second (13-24 weeks) and third (≥25 weeks) stages of pregnancy and the total average weight for both of them were 66 and 69 kg respectively.

Analysis of variance showed that the variation in mother's weight can be explained to be related to stage of pregnancy ($p<0.03$), but not to the three study periods ($p<0.2$). The total mean weight of pregnant mothers at Shaban was slightly higher than the mean weights at other months; however, the variation was not significant.

5.3.2. Height at First Antenatal Clinic

TABLE 5.6

Mother's height at first antenatal clinic

Height (cm)	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
142-149	16	22	16	23	25	33	57	26
150-157	39	54	45	63	40	53	124	57
≥158	17	24	10	14	11	14	38	17
Mean ± SD	154 ± 5		154 ± 5		153 ± 4		154 ± 5	
TOTAL	72	100	71	100	76	100	219	100

Mothers in the sample ranged from 142-167 cm in height, the total average being 154 ± 5. The majority of mothers (57%) fell into the middle height group of 150-158 cm; however 26% of them were short.

Maternal height has been used as an indicator for nutritional status of the mother during her childhood and also for pregnancy outcome (st George *et al.*, 1970). A taller mother is more likely to have a heavier baby than a short mother, who might come from a low social class with higher parity and more living children.

No significant difference was found between mother's height among the three month periods or other variables.

5.4. Clinical and Laboratory Findings

5.4.1. Haemoglobin at First Visit to Antenatal Clinic

TABLE 5.7

Haemoglobin levels at 1st visit

Hg at 1st Visit (gm/dl)	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
7.9 - 9.9	7	10	3	4	9	12	19	9
10.0 - 10.9	14	19	13	19	12	16	39	18
11.0 - 11.9	26	35	30	43	39	51	95	43
$\geq$12	26	36	24	34	16	21	66	30
Mean ± SD	11.4 ± 1.0		11.5 ± 0.9		11.3 ± 1.0		11.4 ± 1.0	

Haemoglobin levels of mothers at first antenatal visit ranged from 7.9 - 14.2 g/dl, the overall mean was 11.4 ± 1. The majority of mothers (73%) fell into the $\geq$11 g/dl haemoglobin group. Nine percent and 18% of mothers were anaemic according to some Saudi hospitals (10 g/dl) and WHO guidelines (<11 g/dl) respectively (Table 5.7).

Overall, 27% of all mothers suffered anaemia according to the WHO standard. There was a significant difference in haemoglobin levels at first visit to antenatal clinic among the three study periods ($p<0.02$). However, a significant association ($p<0.005$) was found between haemoglobin level and stage of pregnancy (Table 5.8).

TABLE 5.8

Haemoglobin levels and stage of pregnancy

Stage of pregnancy (weeks)		Haemoglobin Levels (g/dl) <10		<11		≥11		Total	
		N	%	N	%	N	%	N	%
1	<13	6	32.6	17	43.6	98	61.3	121	56.0
2	(13-24)	8	42.1	20	51.3	45	28.1	73	33.0
3	(25-36)	5	26.3	2	5.1	17	10.6	24	11.0
TOTAL		19	100	39	100	160	100	218	100

More mothers (61.3%) with normal levels of haemoglobin and higher (≥11 g/dl) were in the first stage of pregnancy. Then a gradual decline showed in this percentage in the subsequent stages. This corresponds with the fact that the haemoglobin level declines during pregnancy due to the expansion of the red blood cell mass (Hytten *et al.*, 1980).

A similar relationship also existed between the mean haemoglobin levels and trimesters among the three study periods ($p<0.002$) (Table 5.9).

TABLE 5.9

Haemoglobin levels among Trimesters in Three Study Periods

Stage of Pregnancy (weeks)		Haemoglobin Levels (Mean ± SD) Shaban	Ramadan	Shawal	Total
1	(<13)	11.7 ± 0.9	11.7 ± 1.0	11.0 ± 0.8	11.6 ± 0.9
2	(13-24)	11.0 ± 1.0	11.0 ± 0.9	11.0 ± 1.0	11.0 ± 1.0
3	(25-36)	10.0 ± 1.0	11.0 ± 0.7	11.0 ± 0.9	11.0 ± 1.0

5.4.2. Haematocrit at First Visit to Antenatal Clinic

TABLE 5.10

Haematocrit level at 1st visit

Hct at 1st Visit (%)	Shaban N	Shaban %	Ramadan N	Ramadan %	Shawal N	Shawal %	Total N	Total %
25 - 32.9	19	27	14	20	16	22	49	23
33 - 42	51	73	56	80	58	78	165	77
Mean ± SD	34 ± 3.0		34 ± 2.6		34 ± 3.0		34 ± 2.9	
TOTAL	70	100	70	100	74	100	214	100

The haematocrit level of mothers in the sample ranged from 25-42%, the overall mean being 34 ± 2.9. The majority of mothers (77%) fell into the 33-42% haematocrit group. However, 23% of them had low haematocrit level (25-32.9%).

There were no significant differences in haematocrit level at first visit to antenatal clinic among the three study periods ($p<0.6$), or iron intake. However, haematocrit level was found to be related to stage of pregnancy ($p<0.002$) and the relationship between them followed the same pattern as haemoglobin level with stage of pregnancy (Table 5.11).

TABLE 5.11

Relationship between haematocrit levels and stage of pregnancy

Stage of pregnancy (weeks)		Haematocrit Level <33 N	<33 %	≥33 N	≥33 %	Total N	Total %
1	(<13)	17	35	101	62	118	55
2	(13-24)	26	53	46	28	72	34
3	(25-36)	6	12	17	10	23	11
TOTAL		49	100	164	100	213	100

Similar relationships existed between mean haematocrit levels and trimesters in the three study periods ($p<0.000$) (Table 5.12).

TABLE 5.12

Haematocrit levels among trimesters in the three study periods

Stage of pregnancy (weeks)		Haematocrit Levels (Mean ± SD)			
		Shaban	Ramadan	Shawal	Total
1	(<13)	35.2 ± 2.0	34.7 ± 2.9	34.6 ± 2.0	34.8 ± 2.6
2	(13-24)	33.0 ± 2.6	33.6 ± 2.0	33.0 ± 3.6	33.3 ± 3.0
3	(25-36)	29.0 ± 3.0	33.9 ± 1.7	34.0 ± 2.5	32.5 ± 3.0

5.4.3. Parasitic Infestation

Parasitic infections have been associated with anaemia and poor nutritional status. Anaemic mothers should have stool examinations when their haemoglobin values were less than 11 g/dl. Although 26.5% (58) of mothers were eligible for stool analysis, only 8.7% (19) of them actually had samples tested. Several reasons were stated by mothers for not making the test, which included shortage of time, lack of transportation and working of the husband. Three mothers (1.4%) were found to be infected with parasites, one with *Giardia lamblia* and two with *Entamoeba coli*. These parasites affect the health of the mother and consequently influence the weight of the baby (Ebrahim, 1983). No significant association was found between parasitic infestation and the three study periods or other variables.

5.4.4. Vitamins, Minerals and Traditional Medicine during Pregnancy

TABLE 5.13

Percentages of mothers taking vitamins and minerals

Vitamins & Minerals	Shaban		Ramadan		Shawal		Total	
	N	%	N	%	N	%	N	%
Yes	14	17	15	21	18	24	47	21
No	66	83	56	79	79	58	180	79
TOTAL	80	100	71	100	76	100	227	100

Since this was their first visit, as would have been expected, a low percentage of mothers (21%) had taken vitamins or minerals during pregnancy. Ten percent of mothers had iron and multivitamins, 4% multivitamins only and 6% iron.

Most mothers (65%) with supplements are more likely to be in the second trimester, and middle educated. This supplementation is usually given after three months of pregnancy according to MCH regulations. However, mothers had taken them during or at the end of the three months, probably from private clinics.

As far as traditional medicine before or after pregnancy, all mothers reported negative answers. According to personal observation, some women who could not get pregnant for some years (1-3) after marriage, usually seek either modern medicine or traditional medicine or both. Women who seek traditional medicine are usually given remedies such as mixed herbs, by experienced old men or women, in order to get pregnant or to keep the pregnancy intact.

There were no differences in vitamin and mineral supplements during pregnancy among the three month periods.

5.5. Relationship between Food Habits, Food Intake and Haematological Status

Iron deficiency anaemia, the most common nutritional anaemia worldwide, is a frequent complication of pregnancy, especially in the developing countries (WHO, 1975; Bakers, 1978). About 27% and 23% of respondents in this study had lower haemoglobin and haematocrit levels than WHO guidelines. This is due to the increased demand for iron, usually not met by iron stores or by an increase in dietary intake. Iron status is mainly affected by the availability of iron in the diet. The amounts of iron potentially available from foods depends not only upon the amount of iron supplied, but also the nature of that iron and the composition of the meal (Layrisse *et al.*, 1974).

Heme iron, which comes from animal products, is absorbed to a considerably higher degree than non-heme iron (cereals, legumes, eggs, vegetables and fruits). No significant differences were shown in the mean consumption of foods higher in heme content (beef, lamb, liver) between mothers with low and high haemoglobin and haematocrit levels. However, mothers who met WHO levels of iron intake were more likely to have higher mean consumption of liver ($p<0.04$) and higher mean intake of protein ($p<0.000$), fat ($p<0.02$) and calories ($p<0.01$).

The absorption of non-heme iron might be increased in the presence of animal flesh and vitamin C (Layrisse *et al.*, 1968; Layrisse *et al.*, 1974; Cook and Monsen, 1977). Heme iron present in animal flesh absorbed better than non-heme iron and also enhanced the absorption of non-heme iron from different sources (Layrisse *et al.*, 1974). Red meats formed the major source of heme iron in the diet, although other meats (chicken, fish and meat organs) may contribute to heme iron in the diet, they were not consumed daily, as was meat. Vitamin C has also been shown to increase the absorption of non-heme iron from foods (Cook & Monsen, 1977). Fruits are the major dietary source of vitamin C and it was found that mothers with anaemia had lower mean consumption of oranges ($p<0.09$) and lemons

($p < 0.05$). In addition, mothers with lower intake of iron had a trend towards lower mean intake of vitamin C ($p < 0.06$).

The absorption of non-heme iron may also decrease when the factors inhibiting (fibre, phytate) iron absorption are present (Reinhold *et al.*, 1975; Ismail-Beigi *et al.*, 1977). Bread is a source of iron in the diet and is considered a staple food for Saudi people, particularly consumed at breakfast and dinner in the non-fasting months. Bread made from wholewheat was consumed more frequently in the past and this habit has decreased with an increase in the consumption of white bread. However, a small percentage of mothers still consumed wholewheat bread. The latter has higher fibre and phytate content which may be responsible for lower availability of non-heme iron absorption in the diet. No significant difference in the mean fibre intake between anaemic and non-anaemic mothers was observed.

Tea has also been shown to interfere with absorption of non-heme iron (Rossander *et al.*, 1979). It is consumed mostly at breakfast, dinner and at mid-afternoon snack in non-fasting months and at mid-evening snack in the fasting months, as this study has shown. This tea consumption might have contributed to a decreased iron absorption.

Although there was no significant difference in anaemia in the three month periods, mean iron intake of mothers in Ramadan was lower than other means in the non-fasting months, but it did not reach a significant level. This may be due to a lower consumption of meats/meat products and vegetables, which leads to lower mean intake of protein, fat and vitamin A.

5.6. Summary

The course and outcome of pregnancy are influenced by a woman's previous nutritional status, as well as her diet during pregnancy. Increased nutritional needs during pregnancy have led researchers to assess the nutritional status of pregnant women as a group at high risk of developing nutritional deficiencies. Twenty-four hour dietary recall and food frequency methods were used to estimate the adequacy of energy, nutrient intake and other food items during pregnancy.

The dietary intakes of these women were compared to FAO/WHO (1974, 1985) in an attempt to identify areas of possible nutritional in adequacy among the pregnant women.

The mean intakes of energy and most nutrients (protein, fat, % protein, % fat, % CHO, thiamin, riboflavin and calcium) were lower in Ramadan than in other months, except for fibre which was lower in Shawal and vitamin C which was higher in Ramadan. In addition, N/V were more common during Ramadan and might further reduce nutrient intake.

The mean frequency of some food items consumed during pregnancy agreed in some points with the results of mean intakes of some nutrients and did not agree with others. The low mean intake of energy, protein and vitamin A in Ramadan among women, as revealed by 24-hour recall, were not supported by the higher mean frequencies of lamb, legumes and vegetable consumption in Ramadan than in the other periods. However, the low mean intake of calcium and high mean intake of vitamin C in Ramadan was supported by low and high frequency consumption of milk/milk products and fruits/fruit juices respectively.

About 27% and 23% of mothers were frankly anaemic as judged by haemoglobin and haematocrit levels, without any significant difference in prevalence of anaemia in the three study periods. These results were supported by lower mean intakes of iron, vitamin C and vitamin A which most likely reflects to some extent the cultural food pattern of this group of women, which were lower in meats/meat products, fruits/fruit juices, legumes and vegetables.

It is well established that iron status is affected by the availability of iron in the diet, and the amounts of iron available from foods depends not only upon the amount of iron present, but also the nature of that iron and the presence of factors which may inhibit or enhance its uptake.

Although parasitic infestation has been reported as an important source of anaemia in different places of the world (WHO, 1975; Baker, 1978), only a low percentage of anaemic mothers (1.4%) were infected with parasites. However, we cannot assume that blood loss due to parasitic infestations is a cause of iron deficiency in urban areas, as usually parasites are ubiquitous in rural areas.

CHAPTER VI

FACTORS INFLUENCING MATERNAL DIET AND INFANT FEEDING PRACTICES

6.1. Introduction

The importance of a nutritious diet in maintaining the health of the mother during the period puerperium and lactation, and supporting the satisfactory growth of the infant, is well recognized. Many factors may influence selection of food of mothers as discussed in Chapter III, and clearly many of these factors also influence infant feeding practices.

Many of the constraints on the availability of foods which applied in pregnancy will also limit mothers' choice during puerperium and lactation and in addition food selection will be influenced by dietary beliefs and traditional practices during this period.

These practices and special diets consumed by mothers have long been in existence in developing countries which may affect food intake. Dietary beliefs (food prescription and proscription) are imposed predominantly to protect the mothers and their nursing offspring. The undernourished mother may affect her child's nutritional status not only by providing a smaller volume of milk, but also by being unable to take good care of him.

In many developing countries, the growth and well-being of children during the first five years is dependent to a great extent on breast milk. A trend towards bottle feeding has been a major phenomenon in the urban cities of many developing countries, but a large proportion of mothers are still breast feeding their infants. So that since the composition and quantity of human milk may be affected by the diet consumed by the mother, it is important to know what traditional dietary practices are followed by women during lactation.

Infant feeding study is also important in order to obtain a clear picture of feeding methods and weaning practices existing among Saudi mothers in Dammam, and in addition the possible influence of some factors associated with these practices and to determine to what extent these practices benefit the infants through an assessment of their nutritional status.

6.2. Food Beliefs and Dietary Practices during Puerperium and Lactation

Dietary beliefs and special practices during puerperium and lactation still exist in many cultures, particularly in traditional societies (Wilson, 1973; Snow and Johnson, 1978). These dietary prescriptions and restrictions are meant to guard the health of the infant and the mother and prepare the mother for lactation. Many of these practices are based on the humoral medical system which aimed to correct imbalance during these reproductive periods by using different kinds of foods following the hot/cold concept. Literature on the influence of this concept on the food habits and beliefs during puerperium and lactation are reviewed in the following sections.

6.2.1. Puerperium

After delivery the mother moves to a colder state due to the depletion of heat, blood and vital breath, during parturition, which it is believed leaves her vulnerable to cold and wind. Thus, in some cultures, certain behavioral precautions and customs observed in this period aim to restore heat, blood and breath and to protect the mother and infant from external sources. Failure to observe the customs might result in backache, rheumatism and arthritis. The traditional practice of "seclusion", "confinement", "roasting", "sits for month" for a stated period after the delivery, varying from 10 to 44 days in different cultures (Millis, 1959; Wilson, 1973; Tan, 1982; Ali, 1985). This period permits the mother to rest and allows her to learn to handle and feed her baby.

Special rules may be followed by mothers concerning their clothes, physical movements and food consumption in order to reduce the risk of having cold and wind and also to take care of their babies and themselves. These include wearing heavy clothing and socks, limiting movements and freedom from household tasks, in addition to other practices such as contract the uterus by using salt and restore the youthful figure by binding the abdomen with a cloth (Mathews and Manderson, 1981; Wheeler and Tan, 1983; Wilson, 1973).

As regards food consumption, "cooling" foods are restricted, such as fruits, vegetables, seafood (Tan, 1982), milk and dairy products (Rao, 1984), fish, liquid (Mathews and Manderson, 1981). On the other hand, "heating" foods and "repairing" foods are prescribed to replace the heat which has been lost from the body along with the baby, such as temriah and meat in Iraq (Darwish *et al.*, 1982), aseeda, hesso, hellba, markok, gabout, zatar and lohoom in Kuwait (Prakash *et al.*, 1984), chocolate, garlic, cinnamon and cheese in Puerto Rico (Harwood, 1971), pig's leg cooked in vinegar and ginger, chicken with herbs and rice wine in London by Chinese women (Tan and Wheeler, 1983). Sudanese mothers have been reported to take hot strong black coffee without sugar after delivery to clean the uterus (Ali, 1985), while ethnic Vietnamese women consume large amounts of salt to tighten their muscles (Mathews and Manderson, 1981).

6.2.2. <u>Lactation</u>

Lactation makes considerably greater demands on the mother's body than pregnancy does. The requirements for the production of milk are met by mobilization of the mother's body stores and by an increase in food intake. Dietary intake of lactating mothers in different countries of the world is influenced culturally by food taboos and beliefs. Food restrictions and continued physical work during lactation exacerbate the problem of malnutrition in these groups of women, particularly in developing countries. Lactating mothers may avoid certain foods which are believed to harm the baby, e.g. fish, leek, onion, radish (Darwish *et al.*, 1982), spices, onion, garlic (Prakash *et al.*, 1984), mango, tamarind, urd dal, mirch, tea, achar (Sharma and Gupta, 1980), beef, banana, duck, radish (Tan, 1982). Iranian mothers have been reported to avoid pickles and vinegar which are believed to cause bellyaches in the infant, and also onions, cabbage and garlic because it is believed that taste comes over into the milk. Other Iranian mothers considered cheese to be bad, as when the mother eats it the baby vomits what looks like cheese, and also rice because it is dry and presumably dries up the milk (Geissler *et al.*, 1978b). While Indian mothers in Mysore city avoided fruits, sweets, vegetables, eggs, buttermilk, coconut and fish during lactation due to a belief that these foods cause cold or indigestion in both mother and child (Khannm and Umapathy, 1976).

Other foods were believed to have galactogogic effect which promotes lactation, e.g. methipak (Mital and Gopaldas, 1985), gardencress, fenugreek seeds (Rao, 1984), fenugreek seed, halawa, radish leaves (Abdou and Amer, 1985).

In the Gulf States mothers have their own medicine, herbs and foods believed to stimulate lactation and to enhance the mother's recovery. In Kuwait, 40% of mothers consumed extra milk, meat products and vegetables (Prakash *et al.*, 1984), while in the United Arab Emirates 92% of mothers consumed special foods such as hererowa (made from black pepper, rashad, cinnamon, eggs, fenugreek seeds, ghee, wheatflour), soup, meat, chicken, eggs, fenugreek seeds with honey, ginger and dates.

The reasons given for consuming these foods are to compensate for blood loss during delivery, to regain health and strength, to clean the uterus from dirty blood, to soothe the womb, and to increase the volume of breast milk (Ali, 1981). Similar studies have been carried out in Bahrain and Iraq. Bahraini mothers preferred eating vegetables, fruit, milk, meat and chicken (Musaiger, 1982), but Iraqi women consumed milk, eggs, chicken and meat (Darwish *et al.*, 1982).

6.3. Dietary Intake and Practices during Lactation

Some of these beliefs and taboos mentioned in the previous sections, are beneficial, and others harmful, which may affect and limit the amount of available food for lactating women. In many studies, in different parts of the world, it has been reported that inadequate dietary intakes may affect the volume and composition of the milk of poor mothers (Joint FAO/WHO, 1979; Forsum and Lönnerdal, 1979; Ho, 1981). It is also known that successful lactation depends on many variables, which include the size, vigour and sucking capabilities of the neonate and the mother's ability to synthesize nutrients to produce a sufficient yield of good quality milk and to breast feed under the stresses of modern life (Jelliffe and Jelliffe, 1977). In well-nourished mothers the volume of milk rises gradually from 600 ml/day or less in the first month, to 700-750 ml/day or less in the third month and 750-800 ml/day in the sixth month. However, studies in Asia, Africa and Central America showed that the volume of milk produced by malnourished mothers is less than that produced by well fed mothers. The volume of milk from the former in the first six months varies from 500 to 700 ml/day; and in the second six months below 400 and 600 ml/day (Jelliffe and Jelliffe, 1977). Supplementation of diet of poorly nourished mothers with protein raised the volume of the milk produced.

In India, Belavady and Gopalan reported an increase in milk production of 120 ml when the malnourished women were supplemented with 61-99 gm protein. However, the total protein output was not significantly altered (Gopalan, 1958; Belavady and Gopalan, 1960).

As for the composition of breast milk, there is some variation between well- and mal-nourished mothers. The lactose content remains constant, but the pattern of fatty acids may vary in relation to the mother's past and present diet. The protein vitamin A, water-soluble vitamins may be lowered with inadequate maternal intake.

The energy and nutrient intake of the majority of lactating mothers in the developing world falls below the RDA. The average range of energy intakes that have been reported by a number of studies was 1200-1950 kcal/day with variations due to seasonality (Whitehead, 1983), as compared to 2028-2460 kcal/day for lactating women from industrialized countries (Whitehead and Paul, 1985). Other evidences show that both the mother's own vitamin status and the milk she produces are very sensitive to dietary intake, particularly vitamins C and A (Whitehead and Hartmann, 1983).

Therefore preparation for lactation should begin during pregnancy. Low energy intake as seen in Saudi pregnant women reduces maternal energy reserves which are usually laid down in the earlier part of pregnancy. Women in the poorly-fed communities in developing countries, where many of them are in an almost continuous state of pregnancy or lactation, it seems doubtful that such reserves of fat can be accumulated (WHO, 1965), unless energy requirements during lactation are balanced by food intake. Therefore it is important to assess the adequacy of energy and nutrient intakes of Saudi mothers during lactation, particularly since data concerning this subject are scanty.

6.4. Infant Feeding Practice

Recently there has been a decline in the length of breast feeding in developing nations, as seen in Singapore, Mexico and Kuala Lumpur (Dugdale, 1970; Sanjur *et al.*, 1970; Wong, 1971). The income of the family was a major factor influencing frequency and duration in Kuala Lumpur. There was less breast feeding in the higher income and higher educational level families and mothers working outside the home. Although prolonged breast feeding continues to be practised in rural areas and among most low income groups in the towns and cities of countries like Afghanistan, Jordan, Egypt, Lebanon and Pakistan, the mean duration of breast feeding is becoming increasingly shorter among the younger generation of mothers. The duration of exclusive breast feeding varies from 2 to 18 months, except for male infants who are usually breast fed for a longer period than females.

On the other hand, both exclusive bottle and mixed feeding are predominant in Libya (Harfouche, 1981). The decline in the incidence and duration of breast feeding is associated with promotion of artificial baby foods and feeding bottles. This pattern has also been seen in the poor areas of towns and cities in Iran and Iraq, but to a lesser degree (Harfouche, 1981). In a relatively short space of time, perhaps money, modernity, mothers' employment and commercial advertising, have helped to promote bottle feeding in many countries of the world. These factors have usurped the Quranic tradition of breast feeding for two years. A wet nurse is permissible according to the Quran. She is regarded as the second mother and her children as siblings to the suckled infant and therefore unmarriageable. Today it is most unusual to find a woman breast feeding a baby which is not her own, particularly in big cities, but in some rural areas the practice of wet nursing is still there, as in the Yemen Arab Republic (Harfouche, 1981).

In the Gulf States breast feeding has declined gradually and artificial infant feeding became a sign of modernization in urban and rural communities (Sebai and Turaba, 1981; Sebai *et al.*, 1981; Rahman *et al.*, 1982; Musaiger, 1983; Abdulla *et al.*, 1985; Elias, 1985). Elias (1985) reported that twelve different brands of infants milk were available on the market, some of these brands were not suitable for babies because they were of the wrong composition and also not permitted for sale in Western countries.

The reasons behind the trend away from breast feeding given by women in different studies are: an inadequate milk supply, new pregnancy, employment of mothers working outside, urbanization, availability of acceptable substitutes and lack of medical guidance and support.

It is also found that a higher proportion of the educated mothers in developing countries are using more bottle feeding than breast feeding, since they are away from home most of the time and may regard breast feeding as old-fashioned (WHO, 1981; Musaiger, 1983), whereas in the developed countries there was a tendency for the prevalence of breast feeding to increase with the mother's educational level, such as in Sweden (WHO, 1981).

Other factors that may influence the incidence, duration, adequacy and safety of breast feeding are beliefs and practices that are held by mothers in many cultures around the world. For example, in rural areas of East Java there is a belief that if the previous children died during infancy, a mother should not breast feed the new baby because the milk is considered not good. Such a baby is temporarily given to a foster parent, often a relative. A habit of prolonged breast feeding among Indonesian mothers in rural areas was noticed for a long time, but changes in the duration of breast feeding have now been observed in these rural areas. A fact is that the role of milk powders as a competitor of breast milk is a minor one (Kardjati *et al.*, 1978).

Other harmful and disadvantageous beliefs and customs include the practice of non-use of colostrum in early infancy. This seems to be quite widespread in different parts of the world and its apparent lack of functional and scientific logic. This practice has been seen in Haryana Region in India, where 29% of the mothers were observed to throw away colostrum (first 2 days' milk). Mothers believed it to be harmful for infants and causing gastro-intestinal upsets (Sharma and Gupta, 1980).

Other cultural groups commonly give substances or supplements to the newborn before breast feeding. For example, Northern Thai children from birth are started on supplemental rice or bananas, which are often given prior to breast feeding. This practice leads to decreased consumption of breast milk and as a result these children often develop permanent protein deficits from early infancy (Rosanne and Nancie, 1978).

In the Philippines the newborn is given a laxative, and breast feeding is delayed until the second or third day (Nurge, 1957). As for Saudi Arabia, in semi-rural areas of Central, Western and Eastern (Qatif) parts of the kingdom, mothers seldom breast feed their babies at birth, but they were given sips of water and then semenh, and lactation delayed to the second and third day. Semenh is believed to lubricate the bowel and sometimes castor oil is used in case semenh is not available (Nurge, 1957; Sebai, 1981). A similar practice is also seen in Northern Yemen (Becker, 1984) and in Jordan 80% of the newborns were fed sugar solution after birth. Breast feeding was given from 1-3 days. In Cairo infants below one month were offered some watery substances flavoured with anise, caraway and fenugreek. The anise and caraway water are given to infants in between meals because of their volatile oil content and thus having a carminative action, besides alleviating hunger. Similarly, fenugreek water is offered to the infant due to its soothing action caused by its mucilage content, and sometimes rice water is given when the infant has diarrhoea (Ismail *et al.*, 1965).

In addition, the safety and composition of breast milk may be affected by other maternal factors, e.g. use of kohl, quat and evil eye. Kohl is an eye cosmetic which contains lead and is applied by females regularly. This kohl reaches the infant across the placenta during gestation or through breast feeding. Also it reaches from application of kohl on the eyelids and the umbilical stump of infants, as well as the therapeutic use of lead fumes to avert the ill-effects of the evil eye. This practice, which is prevalent in Arabian countries and Pakistan, could lead to infant lead toxicity. In addition, the toxic effects of kohl occurred at low blood lead levels with hypocalcaemia and rickets, so the mothers who apply it regularly have no opportunity for synthesis of vitamin D_3 from the effects of sunlight on the skin. Such mothers have low blood levels of vitamin D_3 and calcium with the consequence that their infants will be affected through breast feeding (Harfouche, 1981).

In addition to kohl, quat is also well known by women in different societies. In the Yemen, mothers consumed quat very extensively during gestation or breast feeding. It has diverse effects on maternal health, child health, family budget and the economy of the country. It is said that quat reduces the amount of breast milk and affects its quality which leads to serious health problems in the infant. In addition to this, parents who consumed quat have a tendency to neglect their baby's care. Mothers in the Yemen also believed that breast feeding should be avoided after becoming angry or afraid of being exposed to the hot sun.

Evil eye is believed by many people in the world, particularly in Arabian countries. The adverse effect of the evil eye on breast milk may lead to quantitative and/or qualitative changes, or it may act on the milk indirectly by causing sickness to the mother or damage to the breast. The harmful effect of the evil eye on infants varies from milk illness to severe ones. The severe form, which may result in serious illness, disability or death, is the most common (Harfouche, 1981).

6.5. Weaning Practice

Weaning means the process by which the infant gradually becomes accustomed to the full adult diet. During the weaning period the infant's diet changes from milk alone to one based on the family diet. Milk should be given as a supplement to the diet for as long as possible.

The beginning of weaning should start at four to six months of age, when the infant needs more energy and nutrients than the breast milk alone can provide. Therefore supplementary foods should be added gradually to breast or formula feeding and guided by the age, development of growth and condition of the infant. The age at which supplementary foods are given varies widely, reflecting divergent opinions on the ability of the infant's gastrointestinal tract to process the food properly. It also depends upon the culture and the social pressures that the mother feels to start feeding supplements. The Academy of Paediatrics Committee on Nutrition states that a normal full-term infant can thrive on human milk or formula for the first four to six months of life, when the diet is appropriately supplemented with vitamins and minerals (vitamin C, vitamin D and iron) (Krause and Mohan, 1979).

Weaning starts at different times in different communities. In some cultures it does not start until the second six months of life and may extend over more than two years. Researchers in North India have shown that breast fed babies were more likely to survive the early months of life, but between the ages of 9 and 24 months mortality was higher among exclusively breast-fed infants and toddlers than among those receiving food supplements during this period (Joe, 1978).

In Iraq, Demarchi *et al.* (1965) and Zaki (1968) reported that weaning starts at 7 to 12 months with vegetables, cereals, milk and eggs.

As for the Yemen Arab Republic, supplementary feeding other than milk is usually started from the 6th to the 9th month after birth, but in many cases as late as 1½ to 2 years, leading to severe malnutrition. Food is seldom prepared especially for small children and is often deficient in essential nutrients. Some mothers believe that meat, eggs and fish are harmful to small children because these foods are indigestible, produce parasites and make their child stupid. This poor nutritional state is aggravated by other factors such as polluted water, unhygienic conditions and poor bottle feeding practices, leading to the vicious circle of malnutrition and infection.

In urban and rural areas in Egypt, the start of weaning is usually at 6-12 months, and weaning is completed during the second year (Darwish *et al.*, 1982). Other communities start the weaning process very early, before the infant reaches

4 months of age. For example, a recent WHO study shows that many mothers now start to give food other than breast milk to their infants at 2 or 3 months of age. However, in the countries studied, the proportion of rural mothers who started weaning early was not as high as for those in urban areas (Cameron and Hof Vander, 1983).

Weaning is a dangerous time for a child. It is well-known that there is a higher rate of infection and diarrhoea during this period. This is because the diet changes from clean breast milk which contains anti-infective factors, to foods which may be prepared, stored and fed in unhygienic ways. Malnutrition is also common during this period because families may not be aware of the special needs of the infant, may not know how to prepare weaning foods from the foods that are available locally, or may be too poor to provide nutritious foods. Weaning patterns vary from one community to another. Different methods used to provide supplementary foods affect the amount of food the child ingests and the pathogens to which it is exposed. An Indian mother makes porridge and rice into a paste with her fingers, while an Omani mother drips pre-lacteal feeds from her fingertips into her baby's mouth. In other parts of the world mothers premasticate (chew) the food, transferring small pieces to the infant with their fingers or tongues (Gvetel and Lungaho, 1984).

The types of first foods introduced to infants are highly variable from one culture to another. The first food is frequently the staple bread, cereal, rice, tuber or root of the region. Other foods include fruit juices, vegetables, eggs and meat. In rural Africa, Jelliffe *et al.* reported that supplementation with bone marrow, and pre-chewed meat, is given as early as the third month after birth (Jelliffe *et al.*, 1962); while Careal (1977) reported that infant at the age of 5 to 6 months were supplemented with a porridge made of cassava paste and sugar and at the age of 10 to 12 months the infant changed to an adult diet.

In many cultures mothers try to wean their babies from the breast gradually, rather than abruptly preventing them from nursing. A Nigerian mother often introduces the bottle once or twice a day, continuing to breast feed during the evening and night. In other cultures sudden weaning occurs, particularly when the mother becomes pregnant or sick or feels that her milk is inadequate. Sixty-one percent of Bahraini infants were abruptly weaned, as reported by Amine (1980), and 70% of Jordanian mothers weaned their infants suddenly and 30% gradually (Hijazi and Khoury, undated).

Abrupt weaning may be enforced by applying hot spices (black or red pepper) or bitter substances (sabur or quinine) or garlic or ginger to the breast to repel the child. Sometimes the mother smears her breast with pigments to frighten the baby or alters the side opening in her clothing to make it difficult for the baby to nurse. The infant may be separated from the mother completely and sent away to be cared for by relatives. The psychological and nutritional effects of these practices can be very harmful to the young child. Most of these techniques were found among Egyptian mothers, in addition using cautus juice and henna to rub the nipples. These techniques were more common in rural (86%) than urban (53%) areas (Darwish *et al.*, 1982).

Many factors play a part in a mother's decision to wean her child or not. Among the pressures tending to influence mothers in the direction of early weaning is the lack of breast milk, which is usually the most common reason cited by mothers who discontinue breast feeding for a short time. For example, a WHO study of breast feeding in nine countries (Hungary, Sweden, Ethiopia, Nigeria, Zaire, Chile, India, Guatemala and the Philippines) showed that insufficient milk was a reason given by rural mothers among whom prolonged breast feeding was usual, as well as by economically advantaged urban mothers who mostly breast fed for a much shorter time. It would seem that this response was more possibly coloured by cultural factors than by any physiological inability to produce sufficient milk (WHO, 1979).

Employment of mothers in developing countries has led to an increase in early weaning and reduced the presence of the mother in the home. The feeding of the young child is left to the grandmother or to an older child or to a foreign maid (as in the Gulf States) who usually comes from poor, illiterate and often unhealthy cultures. All this could lead to contamination of the bottle or milk, or both, and to the wrong concentration of the feeds.

Also, mothers who move with their families from rural to urban areas undergo great changes in lifestyle. They may find themselves alone, isolated and lost without the extended family life of the rural areas. On the other hand, family expenditure is raised by the cost of rent, food and transplantation. Mothers might therefore be forced to work. This disruption of family life has a definite effect on the health of the infant (El-Shazali, 1981).

The availability of artificial formulae, infant foods and inappropriate advertising have been one of the major factors in early weaning. For example, all types of baby foods and infant formulae from all over the world can be found in the U.A.E., as well as other Gulf States. Baby food prices are relatively high and have no relation to the nutritive value, particularly with regard to protein content (El-Raidy, 1985).

About 50% of U.A.E. infants were fed entirely artificially in 1979. It was found that doctors were excellent publicity agents for baby foods and formulae. In 1981 the situation did not change and there was a decline in breast feeding and bottle feeding was introduced at an early age (1-2 months). One of the main reasons was the recommendation of maternity hospital staff (doctors 71%, nurses 17.5%, and pharmacists 3.6%, and media 12%). The baby food companies also played a good role by distributing free samples of baby milk to newly delivered mothers (El-Raidy, 1985).

Therefore the endorsement of formulae from physician and nurses, as well as advertising in hospitals or by media, could become powerful influences on mothers, particularly on illiterate ones.

Sometimes the mother who uses a formula to feed her child has a large family. It was found that more formula feeding mothers have from 5 to 10 children than did breast feeding mothers. The demands on the mother's time due to the large family size and the convenience of allowing an older person or child to bottle feed the infant may have made formula feeding more easy to use by these mothers. Also, the effect of a high number of pregnancies and childbirths on these mothers' health may have contributed to their decision not to nurse the newborn or to wean her child earlier by using the formula (Kimberly and Carolyn, 1982).

One of the commonest causes for early weaning in the developing countries is new pregnancy. This was found to account for 51% of weaning in the Sudan, 57% in Jordan, 33.2% in semi-urban areas in Bahrain and 67% in two villages in Giza in Egypt. Some women believe that the breast milk of a pregnant woman is harmful to the infant. Mothers in Jordan strongly believe that breast milk of pregnant women might be poisonous and harmful and also they might attribute the failure to thrive of the child to the fact that he was breast fed when the mother was in ignorance of her pregnancy (Hijazi, 1977).

The use of hormonal contraceptives during lactation is increasing in developing countries in recent years. Mothers who use the pills containing oestrogen will have a decline of breast milk volume. However, the reasons that lead to early weaning are not only related to mothers, but also other reasons can be related to the infants themselves. Some of the infant were weaned because it was felt by the mother that they were old enough and could reach for other food on their own.

Others were weaned because of sickness or hospitalization for serious illnesses such as gastroenteritis, pneumonia or others.

6.6. Feeding Method, Diarrhoeal Disease and Gastroenteritis

Diarrhoeal disease is important in the cycle of malnutrition and infection. These are the major causes of morbidity and mortality among the infants and children in developing countries. It was found that one of every 10 children born in these areas dies of diarrhoeal disease before reaching the age of five.

Diarrhoea is caused by any of various bacteria, viruses and parasites, most of which are spread by unsafe drinking water and inadequate sanitary conditions that prevail in many developing countries. Children under five years of age suffer an average of 2 to 3 episode of diarrhoea each year. These episodes, usually in combination with malnutrition, become enough to cause death. Frequent episodes of diarrhoea contribute to malnutrition because appetite decreases, feeding is interrupted and absorption of nutrients is reduced. These events occur, particularly during serious periods of an infant's life, such as the weaning period.

In general, infant feeding with breast milk rather than bottle milk is accompanied by lower rates of diarrhoea and infectious disease. Such protection is believed to be due to several advantages that are found in breast milk. Breast milk contains bacterial and viral antibodies, lactoferrin, lysozymes and immunoglobulin A in the colostrum.

In Jamaica, Al-Mroth and Latham found that 75% of admissions to hospital of children under 2 years of age were due to malnutrition, gastroenteritis and respiratory infection. Malnutrition plays a major role in 44% of deaths of young children. Among children who died, periods of breast feeding were found to have been shorter than in a comparable group of surviving children. Also, it was found that the attack rates of gastroenteritis were significantly higher for infants who bottle or mixed fed, than for infants who had been exclusively breast fed up to 4 months of age in Kingston, Jamaica (Al-Mroth and Latham, 1982).

Diarrhoeal disease and gastroenteritis often result from unhygienic conditions, contamination of feeding bottles, the milk or both, errors in formula preparation and ignorance. For example, in Thaura City on the outskirts of Baghdad, it was found that approximately 61% of mothers used the correct formula preparation, the rest of the mothers either used over-diluted or concentrated preparations (Harfouche, 1981).

In the Lebanon the incidence of wrong formula preparation by low income mothers in Beirut ranged from 49% at one month, to 65% at 12 months. Also, the incidence of boiling decreased with age and ranged from 56% at one month to 2% at 18 months (Harfouche, 1981). In Bahrain, most of the children who were admitted to the Salmaniya Medical Center (1982-1983) were having gastroenteritis. The percentage of these infants (1-12 months) was 44%. The highest percentage of this infection was found among mixed fed infants (54%) and then bottle-fed infants (20%). Supplementary feeding was found to be introduced early at less than 4 months by the percentage of the mothers (47%) (Lankarani *et al.*, 1984). However, in the United Arab Emirates, unhygienic and poor sanitary conditions of bottle feeding was the main causative factor for gastroenteritis in most children. A large percentage of mothers start bottle feeding and supplementary feeding at an early age (1-2 months) (Ali, 1981).

As for Kuwait, gastroenteritis among breast and bottle fed infants was studied by the Unit of Nutrition in the Ministry of Public Health in 1979. The results revealed that the frequency of gastroenteritis attacks was more among bottle fed babies compared to breast fed babies. Also, the severity of the attacks was more among bottle fed babies (31.3%) as gauged by the highest percentage of parenteral treatment they received compared to breast fed infants (7%). It is obvious that malnutrition favours development of diarrhoea, while on the other hand diarrhoea in its turn precipitates and aggravates malnutrition. Gastroenteritis was the major cause of infant mortality as the official report revealed in 1970-1978 (Unit of Nutrition, 1979).

In Saudi Arabia 24% of pre-school children in Central Saudi Arabia suffered from acute under-nutrition of all grades, with maximum frequency in children of 12-23 months old. The reasons given were inadequate supplementation of breast feeding and infection. In addition, bottle feeding has increased in Saudi Arabia during the last few years because of modernization (Zebai, 1981).

Epidemiological studies in several countries have emphasized the role of the nutritional status of the child as an important factor in the aetiology of childhood diarrhoea. Diarrhoea is not only more frequent in children with poor nutritional status, but also tends to be more severe. For example, in a two year study in India it was shown that 60% of under-nourished children suffered from diarrhoeal disease, as compared to 29% of the normal. Moreover, the frequency and duration of diarrhoea increased with deterioration in the nutritional status (Ebrahim, 1981).

6.7. Infant Growth

The growth and development of a child is a result of an interaction between genetic and environmental factors (Warrington and Storey, 1988). Habicht *et al.* (1974) have reported that environmental factors have a greater effect on the growth of children than do ethnic differences. These environmental factors include socio-economic status, infections and disease and nutrition, which is the critical factor as evidenced by a significant dissimilarity in the growth of children in developed versus developing countries, where there are differences in food availability (Wellman, 1978). However, other studies in Third World countries have shown that growth during the first four months of life corresponds well with those of infants in industrialized countries (Jelliffe and Jelliffe, 1978; Waterlow *et al.*, 1980; WHO, 1980). Growth retardation and overt malnutrition are generally observed in the period of transition from exclusive breast feeding to the family diet (Habicht *et al.*, 1974; Waterlow *et al.*, 1980).

Inappropriate weaning foods and the frequent occurrence of infectious diseases are mainly responsible for such a situation. For example, the weights of urban and rural Egyptian infants before the start of weaning ranged between 90% and 100% of the standard weight for age. Within the start of weaning the weight dropped, reading their lowest levels by the age of 12 months. At that age, 95% of urban infants and 85% of rural infants had started weaning. During the second year of life infant weights improved at varying rates (Darwish *et al.*, 1982).

Differences in the growth between breast fed and bottle fed infants are reported by many researchers (Kanaaneh, 1972; Al-Mroth and Latham, 1982). The former are larger and heavier than the latter and less likely to develop severe malnutrition and infections. But Dugdale (1971) has shown no differences in growth of breast and bottle fed infants in developing countries.

6.8. Summary

Lactation represents a drain on maternal body composition. Fat accumulated during pregnancy is used to support milk production, particularly for the first six months. Dietary intake of women, especially in developing countries, might be limited by social and environmental factors and might be further influenced by taboos, beliefs and customs.

Infant feeding practices are also influenced by socio-cultural and economic factors. Breast feeding is a general rule in the Arab world, particularly among rural populations. However, bottle feeding has been introduced and is becoming widespread among higher socio-economic groups and working mothers (Hijazi, 1977; Musaiger, 1977; Nutrition Institute, 1978).

Supplementation of the infant's diet with semi-solid foods, another important aspect of infant feeding, is generally delayed in Arab countries (Nutrition Institute, 1977; Harfouche, 1982), but it is practised from the early months in some societies (Hijazi, 1977).

Information about infant feeding practices, dietary intake of mothers and their food beliefs during lactation is far from comprehensive and has never been the subject of a systematic follow-up study in Saudi Arabia. Hence this was identified as a valuable area of inquiry for Study III.

CHAPTER VII

MATERNAL FOOD HABITS AND DIET DURING PUERPERIUM AND LACTATION

7.1. Aims and Objectives of Study III

This study aimed to examine for the first time various aspects of food habit, dietary beliefs and nutrient intakes of Saudi mothers during puerperium and lactation, in addition to infant feeding practices, infant growth and mothers' anthropometric measurements, over the course of 9 months follow-up.

It was designed to achieve the following objectives:

(1) To examine food habits and food intake of Saudi mothers during puerperium and lactation,

(2) To examine patterns of infant feeding and weaning practices amongst Saudi mothers during the first nine months of children's lives,

(3) To investigate the differences of exclusive breast feeding, exclusive bottle feeding and mixed feeding on the growth of infants by using anthropometric measurements,

(4) To assess the differences in anthropometric measurements between Saudi mothers who breast fed, bottle fed and mixed fed.

7.2. Methods of Data Collection

Due to the expected low level of literacy of mothers, it was essential for the researcher to collect all data by interview using an Arabic questionnaire (see Appendix XII for questionnaire in English). Data for a study was collected on four occasions and was designed to examine food habits and food beliefs of Saudi mothers during puerperium and lactation. In addition, infant feeding practices and anthropometric measurements of both mother and her baby were also investigated at 1 month, 3 months, 6 months and 9 months after delivery.

Mothers were contacted one day after delivery at MC Hospital in Damman and invited to join the study. Those who agreed were given an appointment card for the first interview when their baby reached the age of one month. It contained the name of mother, the place of the interview, the name of the researcher and the date of the interview. At each of the 4 study interviews the following procedures were followed:

(1) The mother's appointment card was checked to ensure that the date of interview corresponded to the date in the researcher's schedule,

(2) Anthropometric measurements of the mother (weight, height, skinfold thickness) and her baby (weight, recumbent length, mid-arm and head circumferences) were made,

(3) An interview was conducted after completing all the anthropometric measurements by using a questionnaire in Arabic. The average length of time required to administer the questionnaire was between 50-60 minutes.

7.2.1. The Interview

There were some differences between the questionnaires used in each part of the study. Copies in English can be seen in Appendix VII.

(A) First interview - baby aged one month (August 24 - October 14, 1986)

During this interview the following information was collected:

Socio-economic data

Personal date (name of mother; age; health record number; address; telephone number; date of interview). Medical data (age at marriage; age at first pregnancy; gravida; parity; number of living children; number of dead children; number of abortions; birth interval period; cooperation of mother). Data on other children (youngest child: name. age. sex, feeding method. health condition; oldest and next to oldest child: names. ages. sexes). Educational level of mother and her husband; mother's occupation; husband's occupation; type of accommodation.

Food ways

Food taken after delivery by mother or baby; special foods consumed during puerperium and lactation and the reasons behind them; 24-hour dietary recall for mother; who cares, cooks and does domestic tasks during puerperium; infant feeding practices.

At the end of the interview the nutritional status of the mother and her infant were assessed by anthropometry.

(B) Second interview - baby aged three months (October 23 - December 14, 1986)

The questionnaire for the second part was the same as the one for the first part, with the omission of questions concerning:

(1) Data on special food consumed during puerperium and reasons for consumption,

(2) Data about mother and her baby while they were in hospital.

Also, further questions were added to the questionnaire, examining the type of food given to the infant during the last two months; the age that food was given, and how the infant responded to it. Questions on changing infant feeding methods and the reasons for this change were also added.

(C) Third interview - baby aged six months (January 20 - March 10, 1987)

The information in the third part of the study questionnaire is the same as in the second part, except for the following data:

(1) Omission of questions on cooking and caring during the past period and 24-hour dietary recall for mother.

(2) A few questions were added, such as the beginning of weaning, how this happened, reasons for weaning the infant at this age and the method used for weaning.

(D) Fourth interview - baby aged 9 months (April 18 - June 7, 1987)

The information collected in the fourth part of the study was the same as in the previous one.

7.2.2. Assessment of Food Intake

As discussed in Chapter IV, the selection of an appropriate method of data collection concerning food intake depends on the nature of the subjects, the research resources and the type of data required (quantitative or qualitative). In view of the levels of literacy of subjects and their level of domestic commitment, the 24-hour recall was selected as a suitable method, particularly since qualitative rather than quantitative data was required. It is simple to perform and places a minimal burden on the subject with low cost and high rates of responses, as compared with other dietary methods (Cameron and Van Staveren, 1988).

However, validation studies have shown that larger food intakes are often underestimated and small intakes overestimated (Madden *et al.*, 1976; Guthrie, 1979), in addition to large intra-individual or day-to-day variation found in groups. Hence it is better to use the 24-hour dietary recall only in examining the mean level of food and nutrient intake of a group (Bingham *et al.*, 1981; Cameron and Van Staveren, 1988).

Food quantities were assessed by using household measures and food models and most mothers were able to do so, but they faced some difficulty in quantifying mixed dishes such as soups and stews.

7.2.3. Anthropometric Assessment

Anthropometric measurements are useful tools which reflect the nutritional status over a lifetime due to pattern of growth and development of the body and are influenced by food intake, genetic and environmental factors. However, nutrition is a critical factor as evidenced by a significant dissimilarity in the growth of children in developed and developing countries, where there are differences in the availability of food (Howard and Herbold, 1982).

The most common anthropometric measurements in use are those meant to assess (a) body mass as judged by weight; (b) linear dimensions, particularly height, head and chest circumferences; and (c) body composition as judged by subcutaneous fat (skinfold thickness) and muscle (mid-arm circumference) (Jelliffe, 1966).

These measurements are relatively easy to take, however, their accuracy and reliability are limited by the skills of the investigator and equipment should be checked frequently throughout the study.

Measurements that were chosen for mothers and infants were:

(1) Weight

(2) Height/recumbent length

(3) Mid-arm circumference

(4) Head circumference

(5) Skin-fold measurements

Measurement techniques

(1) Weight:

Mother's weight was measured by the researcher in the same way as in the second study and infant's weight was measured by beam balance scale to the nearest 0.1 kg. The infant was in very light clothes and dry diaper.

(2) Height/length:

Mother's height was measured in the same way as in the second study. As for the infant, the recumbent length was measured with non-stretch tape. Infants were laid on a flat surface. The head is positioned firmly against the fixed headboard with the eyes looking vertically. The knees were extended by a helper and the feet are flexed at right angles to the lower legs. The upright sliding footpiece was moved to obtain firm contact with the heels and the length measured to the nearest 0.1 cm (Jelliffe, 1966).

(3) Mid-arm circumference:

This was always measured on the respondent's left or non-dominant arm while hanging freely along the body and the mid point was calculated between the tip of the acromion process of the scapula and the olecranon process of the ulna. A non-stretch tape was put around the limb at the midpoint and the measurement was taken to the nearest 0.1 cm.

(4) Head circumference:

Head circumference is related mainly to brain size and to a small extent to the thickness of the scalp tissues and the skull, which can very according to the nutritional status of the infant. The measurement was done with a narrow, flexible, non-stretch tape. The child's head was steadied and the greatest circumference measured by placing the tape firmly round the frontal bones just superior to the supra-orbital ridges, passing it round the head at the same level on each side and laying it over the maximum occipital prominence at the back. Measurements were made to the nearest 0.1 cm (Jelliffe, 1966).

(5) Skinfold measurements:

(a) Triceps skinfold - this was measured on the left arm of the respondent at the mid-arm circumference and the arm was hanging relaxed at the side. The skin-fold parallel to the long axis was picked up between the thumb and forefinger of the left hand, away from the underlying muscle and measured at this point to the nearest 0.1 mm by using Harpenden callipers. The average of three measurements for each respondent was calculated.

(b) Biceps skinfold - the measurement was taken on the left arm at the selected site which was over the mid-point of the muscle belly with the arm resting supinated on the respondent's thigh. The instrument used was the Harpenden skinfold calipers and the measurement was made to the nearest 0.1 mm (Durnin and Rahaman, 1967).

(c) Subscapular skinfold - this was measured just below and laterally to the angle of the left scapula. The fold was taken in a line running at approximately 45° to the spine, in the natural line of skin cleavage. Measurements were taken three times to the nearest 0.1 mm with Harpenden calipers and the average was calculated for each respondent.

7.3. <u>The Study Sample</u>

This study was initiated by contacting all the mothers who delivered healthy babies between July 27 and September 16, 1986. The total number was 295. Ninety-five of them agreed to be followed with their babies as a pair by the researcher for nine months; however only 51 of them cooperated to the end of the study. Each participant had to be contacted once or more to remind her of the next appointment for each visit. The cooperation of respondents was very high during this study. Details on data of the four parts are shown in Table 7.1.

<u>TABLE 7.1</u>

<u>Study Participation (III)</u>

No. delivered women contacted	No. of women agreed to be followed up	No. of women interviewed 1st part study	No. of women interviewed 2nd part study	No. of women interviewed 3rd part study	No. of women interviewed 4th part study
295	95	66	58	51	51
Sex of Infants	48F 47M	37F 29M	30F 28M	27F 24M	27F 24M

7.4. Data Processing and Statistical Analysis

Open-ended questions were coded after the collection of data. Then data was transferred to computer files for analysis using statistical package for social sciences (SPSS-X) and Minitab in the facilities of the King's College Computer Centre.

The statistical significance between variables was determined by chi-square analysis, Student's t-test, and analysis of variance. Relationships between variables were considered statistically significant at the level of 0.05.

Infants' anthropometric data such as length and weight were gathered in three indices (length for age, weight for age and weight for length) and then compared to International Reference Population, as recommended by WHO (1983) and defined by the National Center for Health Statistics (NCHS) in the Unites States.

7.5. Respondents' Characteristics

The characteristics of mothers are summarised in Table 7.2. In terms of age of the mothers, the largest group (45%) was aged between 21-30 years old. The range of age was 18 to 46 years, with an overall mean being 27 ± 6.8. No young mothers under 18 years of age were involved in this study, which might have indicated that these young mothers were too shy to be followed up.

Most mothers (86%) were married young (11-20 years) and 33% were married at a very young age (11-15 years). As a consequence the majority of mothers (80%) had their first pregnancies at or before the age of 20 years, and 23% were first pregnant under 16 years of age. Those mothers who were pregnant at a young age ($\leq$20 years) tended to have higher gravida ($\geq$6), higher parity ($\geq$6) and higher number of living children ($\geq$6). In addition they tended to be illiterate ($p>0.08$), worked as housewives ($p>0.0001$) and had higher percentages of miscarriages and dead children. The total averages of gravida was 4.7 ± 3.0 (range 1-14), parity 4.3 ± 3.0 (range 1-14) and number of living children 4.1 ± 3.0 (range 1-12).

TABLE 7.2

Respondents' characteristics

	N	%
Mother's Age (yrs)		
18-20	13	26
21-30	23	45
31-46	15	29
Mean	27 ± 6.8	-
Total	51	100
Mother's Age at 1st Marriage		
11-15	17	33
16-20	27	53
21-34	7	14
Mean	17 ± 4	-
Total	51	100
Mother's Age at 1st Pregnancy		
11-15	12	23
16-20	29	57
21-34	10	20
Mean	18 ± 4	-
Total	51	100
Gravida		
1-5	32	63
6-10	15	29
11-14	4	8
Mean	4.7 ± 3.0	-
Total	51	100
Parity		
1-5	35	69
6-10	14	27
11-14	2	4
Mean	4.3 ± 3.0	-
Total	51	100
Number of Living Children		
1-5	36	71
6-12	15	29
Mean	4.1 ± 3.0	-
Total	51	100
Deaths among Previous Children		
No deaths	43	84
1 or 2	8	16
Mode	1	-
Total	51	100

Table 7.2 (continued) . . . . .

	N	%
Number of Miscarriages		
No miss	37	72
1 miss	10	20
2 misses	3	6
4 misses	1	2
Mode	1	-
Total	51	100
Average Birth Interval		
11-12 months	5	12
13-24 months	11	26
25-36 months	14	33
37-96 months	12	29
Mode	24	-
Total	42	100
Mother's Education		
Illiterate	14	27
Read and write	6	12
Elementary	10	19
Intermediate	7	14
Secondary	6	12
College	8	16
Total	51	100
Respondent's Husband's Education		
Illiterate	7	14
Elementary	20	39
Intermediate	9	17
Secondary	8	16
College	7	14
Total	51	100
Mother's Work		
Housewife	43	84
Housewife + work outside	8	16
Total	51	100
Respondent's Husband's Work		
Labourer	9	18
Clerk	17	33
Professional	23	45
Retired	1	2
Unemployed	1	2
Total	51	100
Type of Accommodation		
Owned	26	51
Rented	22	43
Shared	3	6
Total	51	100

The birth interval in the sample ranged from 11-96 months, and mode being 24 months. The largest group of mothers (33%) had range birth interval of 25-36 months; however, a minority (12%) fell in the range of 11-12 months group. Mothers (38%) with lower range birth interval (11-24 months) were more likely to have a higher number of miscarriages during their lives, even when these variables were controlled for age. The incidence of miscarriage was also found to decrease with higher level of education ($p<0.05$; Table 7.1A in Appendix VII). Forty-five percent of illiterate mothers had 1 or 2 miscarriages compared with 16% who were literate.

Over a quarter of mothers (27%) in the sample were illiterate. However, as found in the second study, there was a disproportionate percentage (16%) of mothers who had a college education. This reflects the relatively privileged group attending the hospital. Respondents' husbands were more likely to be educated, although 14% were still illiterate. But nearly twice as many men had completed elementary education (39%).

Most respondents (84%) were housewives and the minority (16%) had worked outside in addition. The latter were more likely to be educated and had lower gravida ($p<0.04$), lower parity ($p<0.09$) and fewer living children ($p<0.09$). The majority of respondents' husbands (45%) worked as professionals. Others were working as clerks (33%) or as labourers (18%). Only 2% of husbands were unemployed and 2% were retired.

In terms of accommodation, the majority of respondents (51%) owned their houses, while 43% rented them. However, 6% of mothers were sharing living accommodation with members of extended families.

7.6. Food Beliefs during Puerperium

7.6.1. Foods Taken in the First Hours after Delivery

After women had been delivered in the hospital, the majority of them (78%) did not eat anything for at least eight hours. A choice of food and beverages was provided by the hospital. The common foods consumed were meat soup (37%), orange juice (27%), warm milk (18%) and tomato juice (10%). The reasons behind eating these foods were varied. Meat soup was believed to be a source of warmth (53%) and nourishment (33%), and to compensate for blood loss (13%). Orange (100%) and tomato (25%) juices were taken because they were believed to be nutritious foods and the latter were also believed to aid in replacing blood loss (75%). Fruits (5%) and yoghurt (3%) were eaten by a smaller proportion of mothers. It is possible that food restrictions and other traditional practices were less frequently carried out by these mothers because of the restrictions arising from delivery in a hospital (Mathews and Manderson, 1980).

7.6.2. Beliefs concerning Beneficial Foods during Confinement

Certain beliefs regarding foods and herbs were also mentioned by mothers. Approximately 69% of them believed it was important to eat special foods and herbs during postpartum to protect the health of mother and her baby. The traditional belief is that a mother is in a cold state following childbirth and therefore special foods are wanted to give her warmth and strength. Interestingly, most of these mothers (74%) who believed in eating special foods were educated, compared with 26% uneducated ($p<0.01$). Women named a wide variety of food which might indicate some awareness to the ideas of folk medicine among these mothers.

Fenugreek seeds was the most common item believed by 64% of mothers to be beneficial. It was preferred to be taken with warm water or milk or mixed with cooked foods. One to two teaspoons of fenugreek seeds were taken before or with breakfast and/or before sleep. Fenugreek is rich in protein (26% on dry basis) and also contains some iron. High energy and protein cooked food dishes were also recommended and preferred hot; e.g. aseeda (31%), hassa rice (19%), liver (17%), soups (20%), mataziz (14%), chicken (11%), markok (3%). Spices (black pepper - 3%) and herbs (sawida - 17%, hesso - 8%, rashofa - 11%) are usually added to cooked foods; however, sometimes the latter were taken with liquids as well as rashad recommended (5%) (watercress seeds) and quinine (3%).

Fruits and vegetables were not recommended by mothers, which might be due to the belief that these foods produce cooling effects in the body.

Mothers cited a range of benefits to be obtained from eating these special foods. Cleaning the uterus; calming the stomach; cleaning the body from gas; compensating for blood loss; strengthening the back and general nourishment of the body.

Several reasons were commonly given for each foodstuff and general nourishment was widely mentioned. However, some foods were identified as having special attributes: chicken soup, markok, rashad, sawida, aseeda and rashofa were believed to clean the uterus. Fenugreek and hassa rice were believe to clean the uterus and strengthen the back. Mataziz and hesso were considered useful for their back-strengthening properties, while liver was considered valuable in replacing blood losses. Black pepper was believed to help clean the body of gases and quinine to calm the stomach (see Table 7.2A in Appendix VII).

Only one mother explicitly reported that food would induce warmth to the body. However, it seems very likely that within the idea of restoring health expressed by other mothers was an underlying understanding of this concept as one which involved a warming and balancing effect.

It seems that traces of the hot/cold concept may exist in the Saudi culture, and the need to balance this with warming foods during the postpartum period. Consumption of these foods mentioned by respondents can be related to other heating/cooling conditions. In Saudi Arabia, rashad is commonly consumed to relieve menstrual problems (another "cool" condition) and colds are relieved by soup and adding pepper to foods. While fenugreek and soup are taken more frequently in winter. Mataziz and markok are usually eaten less frequently in the summer. However, it is unclear whether there is a distinction in this case with regard to the concept of "hot" foods and the actual temperature of the items cited. Since in this case all the foods mentioned by the respondents are indeed served hot.

When comparison was made between mother's food beliefs during postpartum and pregnant mothers' intentions for that period (from Study II), it was found that slightly higher proportion (78%) of pregnant mothers believed and intended to eat special foods during that period than the group studied in postpartum (69%), but this difference was not significant. In addition, pregnant subjects mentioned a wider range of foods (43) compared with (19). However, the most frequently mentioned items were similar (Table 7.3) except that aseeda was the most frequent amongst pregnant women compared with fenugreek for postpartum mothers.

Fresh fruits and vegetables were not reported by pregnant women. This might reveal that traces of the "hot/cold" system seem to exist in pregnant women's intentions for postpartum and this is supported by the finding that 8% of them believed that some foods eaten in that period could induce warmth in the body. This was reported in relation to fenugreek (10, 8.5%), rashad (11, 14%), black pepper (14, 88%), aseeda (8, 6%), meat soup (5, 8%), and sawida (2, 6%).

TABLE 7.3

Comparison of beliefs of pregnant women (Study II) with postpartum mothers (Study III) concerning special foods for confinement[a]

Foods	Study II Pregnant Mothers (n=176) N	%	Study III Postpartum Mothers (n=35) N	%
Aseeda	125	71	11	30.6
Fenugreek	118	67	23	63.9
Rashad	77	43	18	50
Meat & chicken soups	73	41.5	5	13.9
Markok	33	18.8	1	2.8
Sawida	33	18.8	6	16.7
Hassa rice	28	15.9	7	19.4
Milk & leben	24	13.9	-	-
Vegetables & chicken	23	13.1	3	8.1
Hesso	22	12.5	3	8.3
Liver	-	-	6	16.7
Mataziz	-	-	5	13.9
Chicken	-	-	4	11.1
Black pepper	-	-	1	2.8
Quinine	-	-	1	2.8

a Each column adds up to more than 100% because one respondent could give more than one answer

Pregnant women in Study II were more likely to suggest reasons of "general nourishment" and "strengthening" and less likely to attach special attitudes like "cleans the uterus" to these foods (Table 7.3A in Appendix VII). They also gave "tradition" as an explanation more frequently. This may be due to the difference in educational levels between the two samples. The sample from Study III contained fewer illiterates and more educated women.

7.6.3. Beliefs Concerning Beneficial/Harmful Foods for Lactation

Beliefs concerning beneficial foods and those to be avoided during lactation were found among Saudi mothers. About 43% believed that certain foods should be eaten and 24% that other foods should be avoided. Foods that were believed to be beneficial for lactation and were most frequently mentioned were milk (82%), juices (18%), salads (9%), leben (9%) and halawa (9%). Some mothers also reported eggs, cheese, soup, liver and fish.

The most common foods believed to be harmful for lactation were spicy foods (33%), raw onions (17%), tea (17%) and others (hot pepper, melon, coffee, orange juice, leben). These foods were believed to be harmful and spoiled the milk during lactation.

7.6.4. Influence of Beliefs on Reported Eating Patterns

When food beliefs were compared with dietary data at the first visit there was a lack of consistency between beliefs and practice, no mothers reported eating fenugreek, rashad, hassa rice, sawida or mataziz (Table 7.4).

TABLE 7.4

Beliefs and practice concerning foods considered beneficial during postpartum[a]

Food items	Believed Beneficial (n=35)		Actually Consumed (n=35)	
	N	%	N	%
Fenugreek	23	63.9	0	0.0
Rashad	18	50.0	0	0.0
Aseeda	11	30.6	4	11.4
Hassa rice	7	19.4	0	0.0
Liver	6	16.7	2	6
Sawida	6	16.7	0	0.0
Vegetable & meat soup	8	20	1	3
Mataziz	5	14	0	0.0
Chicken	4	11.1	6	17.1
Rashofa	4	11.1	0	0.0
Hesso	3	8.3	0	0.0
Markok	1	2.8	1	2.9
Black pepper	1	2.8	0	0.0
Quinine	1	2.8	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

This may be due to the fact that the 24-hour recall data was collected one month after delivery and possibly such dietary practices had been more closely related to beliefs earlier in the puerperium. There were some differences in the eating patterns of those who held beliefs about the benefits of eating certain foods, compared with those who did not. But these were not always consistent (Tables 7.5 & 7.6).

TABLE 7.5

Comparison of beliefs and practice concerning foods considered beneficial during lactation[a]

Food items	Believed Beneficial (n=22)		Actually Consumed at 1st visit: Beliefs (n=22)		No Beliefs (n=16)	
	N	%	N	%	N	%
Milk	18	82	31	141	16	100
Fruit juice	4	18	4	18	5	31
Buttermilk	2	9	14	64	12	75
Vegetables/salads	2	9	12	54	4	25
Egg	1	4.5	15	68	6	44
Cheese	1	4.5	9	41	17	101
Halawa	1	4.5	1	4.5	5	31.3
Soup	1	4.5	3	13.5	0	0.0
Fish	1	4.5	4	18.5	2	12.5
Liver	1	4.5	2	9.1	1	6.3

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

TABLE 7.6

Comparison of beliefs and practice concerning foods considered harmful during lactation[a]

Food items	Believed Harmful (n=22)		Actually Consumed at 1st visit			
			Beliefs (n=22)		No Beliefs (n=16)	
	N	%	N	%	N	%
Spicy foods	4	33.3	0	0.0	0	0.0
Fresh onions	2	16.7	0	0.0	0	0.0
Tea	2	16.7	10	83.3	29	115
Hot pepper	1	8.3	0	0.0	0	0.0
Melon	1	8.3	2	16.7	0	0.0
Coffee	1	8.3	2	16.7	2	7.7
Orange juice	1	8.3	1	8.3	3	11.5
Leben	1	8.3	8	66.7	18	69.2

a Each column adds up to more than 100% because one respondent could give more than one answer.

It is possible those who have not expressed adherence to the value of particular foods may still feel it appropriate to make certain food choices related to traditional ideas, particularly if they are breast feeding. Consequently in the following section this is one aspect of any differences in dietary practices between breast and bottle feeders which will be considered.

7.7. Meal Patterns during Postpartum

7.7.1. Introduction

Culture, customs and environment are important factors which determine the foods to be consumed, the meal patterns and methods of preparation, cooking and eating, as well as food choice, as discussed earlier in relation to pregnancy. A meal is defined as a structured event and foods, time, places and sequence of actions are parts of it, which give the members of the family an opportunity to socialise and communicate. While a snack is an unstructured event and does not follow any rules; e.g. food, time, place and sequence of actions (Douglas and Nicod, 1974).

The meal pattern during this period was similar to that found amongst pregnant women during non-fasting months, which was discussed earlier. Traditionally special meals are prepared and cooked for postpartum mothers in almost all Saudi families. Mothers eat alone, particularly during the 14 days following delivery, and sometimes eat with family members.

7.7.2. Number of Meals and Snacks

The daily meal pattern of mothers during postpartum (1st visit) and after (2nd visit) ranged from 2 - 3 main meals. Most Saudi mothers (84% each visit) had 3 main meals a day at each visit. About 86% of mothers had their meals cooked by someone in the 1st visit, while a smaller proportion (18%) of mothers did so in the 2nd visit.

There was no significant association between the number of main meals in 1st or 2nd visits and mothers' characteristics. However, a trend relationship existed between the number of main meals at 2nd visit and mother's work. Mothers who consumed three meals a day were more likely to be housewives only, probably because they have more time available to prepare these meals than working mothers.

Snacks are light, less important, and may change easily. They were consumed by the majority of respondents in the 1st (75%) and 2nd (80%) visits and only 25% and 20% of mothers had no snacks respectively. Snacks ranged from 1-2 times a day; however, most mothers consumed only 1 snack a day (53% 1st visit, 61% 2nd visit). There was no significant association between the number of snacks in the first and second visits and mothers' characteristics or socio-economic status.

7.7.3. Breakfast

The breakfast meal was taken by mothers between 9.00 and 10.00 hours in the first visit and between 8.00 and 9.00 hours in the second visit. About 90% of mothers in each visit had breakfast and it was taken in the house by 100% and 98% in 1st and 2nd visits respectively. Only 2% ate in a friend's house. A higher proportion of mothers ate this meal alone during postpartum (63%) than after (50%), while 37% and 48% ate with the family respectively. However, 2% ate with their friends in the later visit.

There was no significant difference in the mean number of items consumed at breakfast in the first (4 ± 1.7) and 2nd (4 ± 1.9) visits. The most common foods eaten at breakfast during postpartum and after are shown in Table 7.7.

TABLE 7.7

Food eaten at breakfast[a]

Food items	First Visit (n=46) N	%	Second Visit (n=46) N	%
Milk & milk products	45	97.8	52	113.0
Cereal & bread	40	87.0	80	173.9
Sugar	27	58.7	40	87.0
Egg	20	43.5	17	37.0
Tea	16	34.8	27	58.7
Creamy cheese	15	32.6	10	21.7
Mixed dishes	9	19.6	6	13.0
Coffee	5	10.9	5	10.9
Jam	4	8.7	5	10.9
Meat, fish & liver	4	8.7	5	10.9
Vegetables	3	6.5	2	4.3
Fruits	2	4.3	2	4.3
Honey	2	4.3	3	6.5
Halawa	2	4.3	0	0.0
Peanut butter	1	2.2	0	0.0
Fizzy drinks	0	0.0	1	2.2

a Each column adds up to more than 100% because one respondent could give more than one answer.

Amongst these mothers, the most common breakfast consisted of tea/coffee with milk and sugar accompanying bread, egg and creamy cheese in both visits; however, these foods were eaten more frequently in the 1st visit than the 2nd visit, except for egg and creamy cheese. A smaller proportion of respondents consumed fruits and vegetables and there was no significant difference in consumption of these foods at the two visits. As regard cooked mixed dishes, mothers were less likely to include them at this meal and tended to favour fried egg, aseeda, foul moudamus and humus. These mixed dishes were consumed more often at the 1st (19.6%) than the 2nd (13%) visit. Aseeda is a special dish for postpartum mothers and also a source of high protein and energy as well as halawa, which only appeared at breakfast at the first visit and cereal and bread were more common at the second visit. Differences in the common foods consumed by the mothers according to feeding method are presented in Table 7.8.

Some differences in eating patterns were found between lactating mothers at the first and second visits. Mothers at postpartum tended to eat bread, sugar and tea less frequently than at the second visit, but ate egg, creamy cheese and mixed dishes more often.

Breast feeding mothers were more likely to he having mixed dishes, meat, liver, fish, vegetables and halawa, while none of the bottle feeding mothers did. At each visit breast feeding mothers tended also to consume rather more milk/milk products than bottle feeding mothers. These are foods that were suggested as being helpful in the puerperium promoting lactation and these differences in practice may reflect such beliefs.

TABLE 7.8

Food eaten at breakfast by mothers who breast and bottle fed at first and second visits[a]

Food items	First Visit				Second Visit			
	Breast (n=41)		Bottle (n=5)		Breast (n=39)		Bottle (n=5)	
	N	%	N	%	N	%	N	%
Milk/milk products	41	100.0	4	80.0	45	115.4	5	100.0
Cereals & bread	36	87.8	4	80.0	67	171.8	9	180.0
Sugar	26	63.4	1	20.0	34	87.2	4	80.0
Egg	18	43.9	2	40.0	14	35.9	2	40.0
Tea	16	39.0	0	0.0	22	56.2	4	80.0
Creamy cheese	14	34.1	1	20.0	6	15.4	3	60.0
Mixed dishes	9	22.0	0	0.0	5	12.8	0	0.0
Meat, liver & fish	4	9.8	0	0.0	5	12.8	0	0.0
Jam	4	9.8	0	0.0	5	12.8	0	0.0
Vegetables	3	7.3	0	0.0	2	5.1	0	0.0
Halawa	2	4.9	0	0.0	0	0.0	0	0.0
Peanut butter	1	2.4	0	0.0	0	0.0	0	0.0
Fruits	1	2.4	1	20.0	2	5.1	0	0.0
Honey	1	2.4	1	20.0	2	5.1	0	0.0
Fizzy drinks	0	0.0	0	0.0	1	2.6	1	20.0
Coffee	0	0.0	0	0.0	4	10.3	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

7.7.4. Lunch

On average respondents ate lunch between 13.00 and 14.00 hours in both visits. This meal was taken by 96% of mothers in each visit. All mothers in the first visit had lunch at home with their families, whereas 98% of respondents in the second visit ate at home with their families and 2% in relatives' house. There was no significant difference in the mean number of items consumed during postpartum (3.9 ± 1.8) and after (3.6 ± 1.5). The most common foods consumed during these periods are shown in Table 7.9.

TABLE 7.9

Food eaten at lunch[a]

Food items	First Visit (n=49) N	%	Second Visit (n=49) N	%
Fruits & juices	80	163.3	60	122.4
Mixed dishes	62	126.5	15	30.6
Milk & milk products	21	42.9	17	34.7
Vegetables	20	40.8	28	57.1
Meat, liver & fish	10	20.4	15	30.6
Breads & cereal	2	4.1	5	10.2
Fizzy drinks	1	2.0	1	2.0
Sugar	1	2.0	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

Fruits/fruit juices; mixed dishes and milk/milk products were consumed more frequently in the first visit that second visit; while vegetables, meat, liver, fish and bread were eaten more in the second visit.

Lunch was the main meal in the day and included usually more cooked than convenience items. Mixed dishes are cooked foods which provided energy and protein; e.g. kabsa, rice with shrimp, soups, vegetables and meat stews, markok, jereesh, thareed, sleeq.

Differences in food consumed between mothers according to feeding type are shown in Table 7.10.

TABLE 7.10

Food eaten at lunch by mothers who breast and bottle fed at first and second visits[a]

Food items	First Visit Breast (n=43) N	%	First Visit Bottle (n=6) N	%	Second Visit Breast (n=41) N	%	Second Visit Bottle (n=5) N	%
Fruit/fruit juices	66	153.5	14	233.3	46	112.2	6	120.0
Mixed dishes	55	127.9	7	116.7	50	122.0	7	140.0
Milk/milk products	18	41.9	3	50.0	14	34.1	3	60.0
Vegetables	17	39.5	3	50.0	22	53.7	3	60.0
Meat, liver & fish	10	23.3	0	0.0	12	29.3	1	20.0
Bread & cereals	2	4.7	0	0.0	5	12.2	0	0.0
Fizzy drinks	1	2.3	0	0.0	1	2.4	0	0.0
Sugar	1	2.3	0	0.0	0	0.0	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

Lactating mothers had a tendency to eat more mixed dishes and meat, liver, fish than bottle feeding mothers at the first visit: while less frequently consuming fruit and vegetables and somewhat surprisingly milk and milk products. With the exception of milk consumption these other differences would seem to suggest that lactating mothers were to some extent following traditional ideas about the value of particular foods during this period.

Both groups had less fruit/fruit juices at the second visit and the disparity in milk/milk products consumption persisted. with lactating mothers consuming these even less frequently. However, lactating mothers were eating more vegetables at the second visit and bottle feeding mothers had increased their consumption of mixed dishes, meat, fish and liver.

7.7.5. Dinner

Dinner is a regular meal for almost all respondents in first (98%) and second (92%) visits. It was taken between 21.00-22.00 hours at both visits. All postpartum mothers were at home to have this meal, and the majority (96%) shared it with family members. Only a small proportion of respondents (4%) had dinner alone; whereas after postpartum most mothers (98%) consumed dinner at home and of them 94% ate with family member and the remainder were alone. A small proportion (2%) of mothers took this meal at their relative's house.

There was no significant difference in the mean number of food items consumed at dinner in the 1st (3.6 ± 1.5) and 2nd (3.5 ± 1.8) visits. The most common foods eaten in this meal are presented in Table 7.11.

TABLE 7.11

Food eaten at dinner[a]

Food items	First Visit (n=50)		Second Visit (n=47)	
	N	%	N	%
Bread & cereals	37	74	36	76.6
Mixed dishes	33	66	36	76.6
Milk/milk products	30	60	22	46.8
Fruits/fruit juices	28	56	26	55.3
Sugar	11	22	7	14.9
Meat, liver & fish	10	20	11	23.4
Tea	8	16	5	10.6
Coffee	0	0.0	1	2.1
Egg	7	14	10	21.3
Vegetables	6	12	13	27.7
Fizzy drinks	5	10	2	4.3
Creamy cheese	4	8	4	8.5
Sugary foods	2	4	1	2.1
Halawa	2	4	3	6.4
Jam	1	2	3	6.4

a Each column adds up to more than 100% because one respondent could give more than one answer.

Milk/milk products, sugar, tea, fizzy drinks were more common among mothers in the first than second visit, while mixed dishes, eggs, vegetables, halawa and jam were more common in the second than the first visit.

Differences in common foods consumed by mothers according to feeding type are presented in Table 7.12.

TABLE 7.12

Food eaten at dinner by mothers who breast and bottle fed at first and second visits[a]

Food items	First Visit				Second Visit			
	Breast (n=45)		Bottle (n=5)		Breast (n=38)		Bottle (n=6)	
	N	%	N	%	N	%	N	%
Cereals & bread	34	75.6	3	60.0	32	84.2	2	33.3
Mixed dishes	29	64.4	4	80.0	28	73.7	4	66.7
Milk/milk products	28	62.2	2	40.0	20	52.6	1	16.7
Fruit/fruit juices	25	55.6	3	60.0	19	50.0	7	116.7
Sugar	10	22.2	1	20.0	7	18.4	0	0.0
Meat, liver & fish	9	20.0	1	20.0	10	26.3	1	16.7
Tea	7	15.6	1	20.0	5	13.2	0	0.0
Egg	7	15.6	0	0.0	6	15.8	2	33.3
Vegetables	6	13.3	0	0.0	10	26.3	3	50.0
Fizzy drinks	5	11.1	0	0.0	1	2.6	0	0.0
Creamy cheese	4	8.9	0	0.0	2	5.3	1	16.7
Halawa	2	4.4	0	0.0	3	7.9	0	0.0
Sugary foods	2	4.4	0	0.0	1	2.6	0	0.0
Jam	1	2.2	0	0.0	1	2.6	1	16.7
Coffee	0	0.0	0	0.0	1	2.6	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

At the first visit a higher proportion of breast feeding mothers ate cereal and bread, milk and milk products, eggs and creamy cheese than bottle feeding mothers. They were less likely to eat mixed dishes and vegetables. Interestingly at both visits, halawa and sugary foods, believed to be beneficial, were only reported by lactating mothers and milk/milk products were also consumed more frequently by them, although there was a decline between the two visits. Their consumption of vegetables increased between the first and second visit but to a level that was lower than the bottle-feeders at the second visit.

7.7.6. Morning Snack

Only 22% (11) and 37% (19) of respondents claimed to have this snack during mid-morning at 11.00 hours and 10.00 hours in the 1st and 2nd visits respectively. Eating at home was done by the majority of postpartum mothers (82%) and of them 73% ate alone, 9% shared it with the family and 18% with neighbours. After postpartum most respondents (95%) had this snack at home and 5% at neighbour's house. About 84% ate alone and the remainder 916%) with neighbours.

The number of food items consumed in this snack ranged from 1-4 in both visits. A high proportion of mothers (42%) who had this snack had 2 food items in the second visit compared to 27% in the first visit. The most common foods in mid-morning snack are shown in Table 7.13.

Mothers at the second visit consumed a greater variety of foods than the ones at the first visit and were more likely to include cereals/bread, milk/milk products or mixed dishes.

TABLE 7.13

Food eaten at morning snack[a]

Food items	First Visit (n=11) N	First Visit (n=11) %	Second Visit (n=19) N	Second Visit (n=19) %
Fruits/fruit juices	9	81.8	14	73.7
Tea	2	18.2	3	15.8
Cereals & bread	2	18.2	7	36.8
Sugar	2	18.2	3	15.8
Mixed dishes	1	9.1	3	15.8
Halawa	1	9.1	0	0.0
Vegetables	1	9.1	0	0.0
Creamy cheese	1	9.1	1	5.3
Milk/milk products	0	0.0	7	36.8
Sugary foods	0	0.0	1	5.3
Fizzy drinks	0	0.0	3	15.8
Honey	0	0.0	1	5.3

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

Differences in the food commonly eaten at this snack among breast and bottle feeders are shown in Table 7.14.

TABLE 7.14

Food eaten at mid-morning snack by mothers who breast and bottle fed at first and second visits[a]

Food items	First Visit Breast (n=11) N	First Visit Breast (n=11) %	First Visit Bottle (n=0) N	First Visit Bottle (n=0) %	Second Visit Breast (n=13) N	Second Visit Breast (n=13) %	Second Visit Bottle (n=5) N	Second Visit Bottle (n=5) %
Fruit/fruit juices	9	81.8	0	0.0	10	76.9	4	80.0
Cereals & bread	2	18.2	0	0.0	4	30.8	3	60.0
Tea	2	18.2	0	0.0	2	15.4	1	20.0
Sugar	2	18.2	0	0.0	2	15.4	1	20.0
Vegetables	1	9.1	0	0.0	0	0.0	0	0.0
Mixed dishes	1	9.1	0	0.0	2	15.4	1	20.0
Halawa	1	9.1	0	0.0	0	0.0	0	0.0
Creamy cheese	1	9.1	0	0.0	1	7.7	0	0.0
Sugary foods	0	0.0	0	0.0	1	7.7	0	0.0
Fizzy drinks	0	0.0	0	0.0	3	23.1	0	0.0
Milk/milk products	0	0.0	0	0.0	4	30.8	2	40.0
Honey	0	0.0	0	0.0	0	0.0	1	20.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

At the first visit only lactating mothers reported eating this snack. Fruit/fruit juices were popular and somewhat surprisingly no-one reported having milk/milk products. At the second visit about a third of lactating mothers reported consuming these items, but this was still slightly less common than among bottle feeding mothers. Cereals and bread were reported by a higher number of bottle feeding mothers at the second visit, while fizzy drinks were more popular among lactating mothers.

7.7.7. Afternoon Snack

About 61% (31) and 55% (28) of mothers claimed to have this snack during the afternoon period between 16.30 - 17.00 hours in both visits. Eating in the house was done by all postpartum mothers (100%) and of them 71% shared it with family members and 29% ate alone. At the second visit, the majority of all respondents (96%) had this snack at home and of them 74% shared it with family members and the remainder (26%) ate alone. However, only 4% claimed to have it at a relative's house. Most respondents in the first (62%) and second (50%) visits consumed 2 food items, and there was no significant difference between them. The most common food items consumed during the mid-afternoon period are presented in Table 7.15.

TABLE 7.15
Food eaten at afternoon snack[a]

Food items	First Visit (n=31)		Second Visit (n=28)	
	N	%	N	%
Tea	22	71.0	18	64.3
Sugar	19	61.3	18	64.3
Fruit/fruit juices	9	29.0	15	53.6
Milk/milk products	6	19.4	2	7.1
Bread	1	3.2	0	0.0
Sugary foods	1	3.2	7	25.0
Halawa	1	3.2	0	0.0
Creamy cheese	1	3.2	0	0.0
Fizzy drinks	0	0.0	2.0	7.1

a Each column adds up to more than 100% because one respondent could give more than one answer.

Tea, milk/milk products, bread, halawa and creamy cheese were more commonly food consumed by mothers in postpartum than after. Differences in these common foods eaten by mothers with different feeding type are presented in Table 7.16.

TABLE 7.16

Food eaten at afternoon snack by mothers who breast and bottle fed at first and second visits[a]

Food items	First Visit				Second Visit			
	Breast (n=29)		Bottle (n=2)		Breast (n=24)		Bottle (n=2)	
	N	%	N	%	N	%	N	%
Tea	20	69.0	2	100.0	16	66.7	1	50.0
Sugar	18	62.1	1	50.0	11	66.7	1	50.0
Fruits/fruit juices	8	27.6	1	50.0	13	54.2	2	100.0
Milk/milk products	6	20.7	0	0.0	1	4.2	0	0.0
Bread & cereals	1	3.4	0	0.0	0	0.0	0	0.0
Sugary foods	1	3.4	0	0.0	6	25.0	0	0.0
Halawa	1	3.4	0	0.0	0	0.0	0	0.0
Creamy cheese	1	3.4	0	0.0	0	0.0	0	0.0
Vegetables	0	0.0	0	0.0	1	4.2	0	0.0
Fizzy drinks	0	0.0	0	0.0	1	4.2	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

At both visits fewer lactating mothers had fruit or fruit juice at this snack than bottle feeding mothers. Although the numbers doing so increased between the first and second visit. Breast feeding mothers were more likely to have those foods believed to be especially good; e.g. milk/milk products, sugary foods, halawa and creamy cheese on both occasions.

7.7.8. Evening Snack

Approximately 16% (8) and 10% (5) of respondents had this meal during mid-evening period between 22.30 - 23.00 hours in both visits. In most circumstances this snack was taken at home by 100% and 60% of mothers at postpartum and after respectively. But it was shared with family members by a smaller proportion of respondents in the 1st (25%) and 2nd (20%) visits respectively. The remainder of mothers ate alone (75% 1st visit, 60% 2nd visit). Only 20% of respondents took this meal at their relatives' house after postpartum.

The majority of mothers had one food item during mid-evening snack in 1st (75%) and 2nd (60%) visits. The most common foods eaten in this snack are shown in Table 7.17.

TABLE 7.17

Food eaten at evening snack[a]

Food items	First Visit (n=8)		Second Visit (n=5)	
	N	%	N	%
Milk/milk products	5	62.5	2	40.0
Fruit/fruit juices	3	37.3	1	20.0
Sugar	2	25.0	1	20.0
Tea	0	0.0	2	40.0
Mixed dishes	0	0.0	1	20.0

a Each column adds up to more than 100% because one respondent could give more than one answer.

Milk/milk products, fruit/fruit juices, sugar were more commonly consumed by mothers at the 1st than the 2nd visit. Differences in consumption of common foods by mothers with different feeding type are presented in Table 7.18.

TABLE 7.18

Food eaten at evening snack by mothers who breast and bottle fed at first and second visits[a]

Food items	First Visit				Second Visit			
	Breast (n=7)		Bottle (n=1)		Breast (n=4)		Bottle (n=10)	
	N	%	N	%	N	%	N	%
Milk/milk products	5	71.4	0	0.0	2	50.0	0	0.0
Fruit/fruit juices	2	28.6	1	100.0	1	25.0	0	0.0
Sugar	2	28.6	0	0.0	1	25.0	0	0.0
Tea	0	0.0	0	0.0	1	25.0	1	100.0
Mixed dishes	0	0.0	0	0.0	1	25.0	0	0.0

a Each column adds up to more than 100% because one respondent could give more than one answer.

Only one mother who bottle fed her baby had an evening snack, fruit/fruit juices at the first visit and tea at the second visit. However, the lactating mothers in the first visit consumed milk/milk products, fruit/fruit juices and sugar, although fewer mothers had milk/milk products at the second visit.

7.8. Effects of Support during Confinement

Traditionally a Saudi mother stays in bed for a certain period of time after delivery in order to protect herself from catching wind or cold. This time of confinement varied from 1 week to 40 days. During this confined period mothers (particularly first time), were not allowed to do any household tasks or cooking, even child care. In this study general household tasks and cooking were performed mostly by relatives and respondents' mothers at the first visit, while respondents were doing both tasks themselves at the second visit (Table 7.19).

TABLE 7.19

Persons in charge of caring and cooking during postpartum and after

	First Visit (During Confinement)				Second Visit (After Confinement)			
	Caring		Cooking		Caring		Cooking	
	N	%	N	%	N	%	N	%
Respondent's mother	24	47	23	45	1	2	1	2
Relatives	26	51	20	39	1	2	5	10
Maid	1	2	1	2	6	12	3	6
Respondent	0	0	7	14	43	84	42	82

This support should benefit the new mother and enable her to regain her strength. Therefore it was of interest to examine what, if any, effects the presence of helpers had on meal patterns and nutrient intakes.

Eating patterns

At the first visit, respondents who were being cared for by others reported eating more frequently and eating a wider range of foods. Those who were responsible for doing the cooking themselves were less likely to eat three meals each day and more likely to eat no snacks at all (Table 7.20).

TABLE 7.20

Number of snacks and meals according to caretaker

	First Visit						Second Visit			
	Mother (23)		Other (21)		Respondent (7)		Other (9)		Respondent (42)	
Snack										
1	12	52	13	62	2	29	5	56	26	62
2	4	17	6	29	1	14	2	22	8	19
None	7	30	2	9	4	57	2	22	8	19
Meals										
1 or 2	3	13	3	14	2	29	2	22	6	14
3	20	87	18	86	5	71	7	78	36	86

Not only were there differences in the frequency of eating, but also in the foods consumed. Since there were substantially fewer respondents looking after themselves at the first visit (7) than were looked after by their mothers (23) or others (21), it is not surprising that there were a smaller number of different food items mentioned at each eating occasion. However, when broad food groups were considered, it was clear that some food types were not included at all at meals and snacks eaten by respondents who looked after themselves in contrast to those who were cared for (Table 7.21).

TABLE 7.21

Meal patterns and care taker at first visit[a]

	Mother (22)		**Other (19)**		**Respondent (5)**	
	N	%	N	%	N	%
Breakfast						
Milk/milk products	22	100	16	84.2	5	100
Tea	6	27.3	7	36.8	3	60
Coffee	1	4.5	4	21	0	0.0
Cereal & bread	21	95	14	74	5	100
Egg	10	46	8	42	2	40
Fruits/fruit juices	1	4.0	1	5	0	0.0
Vegetables	2	9	1	5	0	0.0
Meat, fish, liver	1	4	1	5	0	40
Mixed dishes	5	23	2	11	0	0.0
Creamy cheese	7	32	7	37	1	20
Sugar	12	54	12	63	3	60
Honey, jam & halawa	5	23	3	16	0	0.0
Lunch						
Milk products	7	32	9	45	5	71
Bread	1	4	1	5	0	0.0
Fruit/fruit juices	34	154	31	155	15	214
Vegetables	9	41	9	45	2	29
Meat, liver, fish	3	14	5	25	2	29
Mixed dishes	29	132	26	130	7	100
Fizzy drinks	0	0.0	1	5.0	0	0.0
Sugar	0	0.0	0	0.0	1	14

Table 7.21 (continued) . . . . .

	Mother (22)		Other (19)		Respondent (5)	
	N	%	N	%	N	%
Dinner						
Milk products	15	68	9	43	6	86
Tea	3	14	5	24	0	0.0
Cereal	18	82	14	67	5	71
Egg	4	18	3	14	0	0.0
Fruit/fruit juices	12	55	13	62	3	43
Vegetables	3	14	3	14	0	0.0
Meat, liver, fish	5	23	3	14	2	29
Mixed dishes	16	73	14	67	3	43
Creamy cheese	1	4	3	14	0	0.0
Sugar	4	18	6	29	1	14
Sugary foods	3	14	1	5	0	0.0
Fizzy drinks	0	0.0	4	19	1	14
Morning Snack						
No snack	20	86	14	66	6	86
Fruit/fruit juices	2	67	5	71	2	200.0
Mixed dishes	1	33	0	0.0	0	0.0
Tea	0	0.0	2	29	0	0.0
Cereal	0	0.0	2	29	0	0.0
Vegetables	0	0.0	1	14	0	0.0
Sugar	0	0.0	2	29	0	0.0
Halawa	0	0.0	1	14	0	0.0
Creamy cheese	0	0.0	1	14	0	0.0
Afternoon Snack						
No snack	10	43	6	28	4	57
Milk/milk product	4	30	2	13	0	0.0
Fruit/fruit juices	4	31	1	7	1	33
Bread	0	0.0	0	0.0	1	33
Tea	9	69	11	73	2	67
Sugar	8	62	9	60	2	66
Sugary foods	0	0.0	1	7	0	0.0
Halawa	0	0.0	1	7	0	0.0
Creamy cheese	0	0.0	0	0.0	1	33
Evening Snack						
No snack	19	83	18	86	6	86
Milk/milk products	4	100	1	33	0	0.0
Fruit/fruit juices	0	0.0	2	67	1	100
Sugar	2	50	0	0.0	0	0.0

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

For example, respondents who looked after themselves did not include any fruit, vegetables or mixed dishes at breakfast, which suggests that they were not only eating less frequently but also had less variety in their diet. It is understandable that new mothers, without help, would respond by simplifying meal preparation and one way in which this appears to be demonstrated is the less frequent consumption of mixed dishes. While snacks consisted almost exclusively of fruit and fruit juice. Respondents who were cared for by their mother or others included a range of other foods, including milk products and cooked dishes and also sugary foods and halawa. As we have seen earlier, sugary foods and halawa are considered warming and therefore helpful during the postpartum period. These too were absent from the recalls of respondents who looked after themselves and most common when she was looked after by her mother. The other favoured foods such as aseeda, mataziz, soup and markok only appeared in the 24-hour recall records of respondents who were cared for by others; which provides an interesting insight into the role of these carers as agents for the continuation of traditional practices. However, when the prevalence of holding beliefs about the value or harm attached to certain foods was examined in relation to whether others were involved in the care of the new mother, there was no relationship and mothers who cooked for themselves were just as likely to believe that certain foods were good or bad for lactation.

When considering the nutrient intakes of these groups of respondents (Table 7.4A in Appendix VII), the difference in eating frequency does appear to be reflected in energy intake. Energy intakes of respondents looked after by others (2011 kcals) and their mothers (1885 kcals) being higher than those who looked after themselves (1581 kcal). But interestingly the protein intake as a percentage of energy was lowest (19%) when the respondent's mother was preparing food, compared with 28% when other relatives or the respondent (30%) was cooking. This may be due to the effects of sugary foods encouraged by mothers and others, since intakes of fat and carbohydrate were higher amongst respondents who were cared for. Iron intakes also appeared to be lower when mothers were in control of cooking (13 mg) compared with the others (21 mg) or the respondent herself (21 mg).

By the second visit respondents were eating snacks with similar frequency, whether or not they had help and were more likely to be eating three meals a day if they were doing the cooking themselves. The nature of the foods eaten at mealtimes was also substantially the same (Table 7.22).

TABLE 7.22

Meal patterns and care taker at second visit[a]

	Others (9)		Respondent (42)	
	N	%	N	%
Breakfast				
Milk/milk products	7	100	45	115
Tea	5	71	22	56
Cereal	11	157	69	177
Eggs	3	43	14	36
Mixed dishes	2	29	4	10.3
Honey or jam	2	28	6	15
Meat, liver, fish	0	0.0	5	13
Fruit/fruit juices	0	0.0	2	5
Vegetables	0	0.0	2	5
Creamy cheese	0	0.0	10	26
Fizzy drinks	0	0.0	1	3
Lunch				
Milk/milk products	1	12.5	16	39
Cereals	1	12.5	4	9.8
Fruit/fruit juices	13	162	47	115
Vegetables	5	62	23	56
Mixed dishes	9	112.5	50	122
Meat, fish, liver	3	37.5	12	29.3
Fizzy drinks	0	0.0	1	2.4

continued over . . . . .

Table 7.22 (continued) . . . . .

	Others (9)		Respondent (42)	
	N	%	N	%
Dinner				
Milk/milk products	1	11	21	55
Tea	1	11	4	10.5
Cereal	7	78	29	76
Eggs	2	22	8	21
Fruit/fruit juices	6	67	20	53
Vegetables	3	33	10	26
Mixed dishes	6	67	30	79
Sugar	1	11	1	2.6
Meat, liver, fish	1	11	10	26
Fizzy drinks	0	0.0	2	5.3
Halawa	0	0.0	3	8
Creamy cheese	0	0.0	4	10.5
Morning Snack				
No snack	5	55	27	66
Milk/milk products	2	50	5	33
Tea	0	0.0	3	20
Cereal	2	50	5	33
Fruit/fruit juices	1	25	13	87
Mixed dishes	2	50	1	7
Fizzy drinks	2	50	1	7
Sugar	1	25	3	20
Honey	0	0.0	1	7
Creamy cheese	0	0.0	1	7
Afternoon Snack				
No snack	4	44	19	45
Tea	3	60	15	65
Fruit/fruit juices	3	60	12	52
Sugary foods	1	20	6	26
Sugar	3	60	15	65
Milk/milk products	0	0.0	2	9
Vegetables	0	0.0	1	4.3
Fizzy drinks	0	0.0	2	9
Evening Snack				
No snack	9	100	37	88
Milk/milk products	0	0.0	2	40
Tea	0	0.0	2	40
Mixed dishes	0	0.0	1	20
Fruit/fruit juices	0	0.0	1	20
Sugar	0	0.0	1	20

[a] Each column adds up to more than 100% because one respondent could give more than one answer.

Although when respondents were responsible for food preparation there was still a tendency for mixed dishes to be consumed less frequently at breakfast and as snacks; at most eating occasions these mothers were also more likely to be eating milk/milk products.

These patterns were reflected in the nutrient intakes which showed a tendency towards higher energy and higher protein intakes when respondents were cooking for themselves and higher carbohydrate consumption when they were looked after by others (Table 7.5A in Appendix VII).

Looking at changes in the respondents' weights between the two visits in relation to who was cooking the food, respondents who were looked after by their mothers were less likely to lose weight and more likely to gain weight than respondents when food was cooked by others ; (Table 7.23).

TABLE 7.23

Weight change in mothers according to care taker

Who Cooks	Lost Weight N	Lost Weight %	Stayed Same N	Stayed Same %	Gained Weight N	Gained Weight %
Respondent's mother	4	17	12	52	7	31
Other	11	52	8	38	2	10
Self	1	14	4	57	2	28

The amount of weight lost was greater for the respondent who cooked for herself (5.8 kg) compared with a mean weight loss of 2.6 kg when others cooked, and 2.0 kg when the respondent's mother cooked. Weight gain was also least when respondents cooked for themselves, 1.35 kg on average compared with 2.4 kg when respondent's mothers and others cooked.

7.9. Energy and Nutrient Intakes of Mothers during Postpartum and After

7.9.1. Introduction

Adequate diet for mothers during postpartum and later, particularly for lactating mothers, is very important because their extra nutritional requirements need to be met not for their own health, but also for the well-being of their children (WHO, 1985). In many of the developing countries, the growth and health of children during the first five years is dependent on breast milk. The lactation performance of a mother is known to be influenced by the adequacy of her diet (Gopalan and Belavady, 1961; Butte *et al.*, 1984). The volume and composition of human milk can be affected by maternal nutrition (WHO, 1981; WHO, 1985). International daily recommendation of energy and nutrient intakes (WHO, 1974 & 1985) was used to measure the adequacy of mothers' diet during postpartum (1 month after delivery) and after (2 months later).

7.9.2. Nutritional Implication of Energy and Nutrient Intakes during Postpartum and After

As can be observed from Table 7.24, the majority of respondents in both visits had low energy intake as compared to FAO/WHO recommended level (1974; 1985), with a higher mean energy intake in the first visit than the second visit. Low energy intake is likely to be due to underestimation of fat and oil intake, in addition a great proportion of mothers consumed mixed dishes, for most of which no compositional data is available. However, the proportion of the total energy intake derived from fat intake was fairly high at both visits (34 ± 10.5 for the 1st visit, 35.5 ± 9 for the 2nd visit).

TABLE 7.24

Energy and nutrient intakes of all mothers during postpartum and after

	First Visit				Second Visit				Total Mean		T-test	
	Less std		Std & more		Less Std		Std & more		1st visit	2nd visit	T-value	S.S.
	N	%	N	%	N	%	N	%				
Energy (kcal)	37	72	14	28	43	84	8	16	1895 ± 698	1699 ± 622	1.9	0.06
Protein (g)	3	6	48	94	2	4	49	96	78.6 ± 33	73 ± 21	1.2	N.S.
Carbohydrate (g)	49	96	2	4	50	98	1	2	175.6 ± 64	158.8 ± 67	2.09	0.04
Fat (g)	24	47	27	53	33	65	18	35	73 ± 36	69 ± 31	1.13	N.S.
Thiamin (mg)	35	69	16	31	35	69	16	31	0.8 ± 0.3	0.8 ± 0.3	0.1	N.S.
Niacin (mg)	19	37	32	63	14	28	37	72	18.7 ± 9	19.9 ± 7.6	-0.8	N.S.
Riboflavin (mg)	23	45	28	55	21	41	30	59	1.8 ± 1.2	1.8 ± 1.4	0.06	N.S.
Vitamin B12	30	59	21	41	34	68	16	32	2.1 ± 1.8	1.9 ± 2.0	0.5	N.S.
Vitamin B6	10	20	41	80	28	55	23	45	2.4 ± 0.7	1.8 ± 0.9	4.5	0.00
Vitamin C (mg)	13	25	38	75	12	23	39	77	65.6 ± 39	63 ± 33	0.4	N.S.
Vitamin A (ug)	37	72	14	28	39	76	12	24	487 ± 354	541 ± 351	-0.9	N.S.
Iron (mg)	29	57	22	43	22	43	29	57	17.7 ± 12.2	18.5 ± 10.7	-0.4	N.S.
Calcium (mg)	4	8	47	92	5	10	46	90	1195.9 ± 586	1205 ± 381	-0.1	N.S.
Fibre (g)	48	94	3	6	44	86	7	14	5.7 ± 3	5.5 ± 4	0.4	N.S.

There were significant differences ($p < 0.02$) between the mean energy intakes of lactating and bottle feeding mothers at the first visit, with lactating mothers having higher energy intakes (2,002 kcals) than bottle feeding mothers (1,295 kcals) or mixed feeders (1,830 kcals). This was the result of lactating respondents consuming more food with higher energy content; e.g. mixed dishes, halawa, cheese. However, all these energy intakes were below the WHO recommended level.

These differences in energy intake appear to have been reflected in maternal weight change between visit one and two. A higher proportion of bottle feeders lost weight and, unlike the breast feeding and mixed feeding mothers, none of them gained weight (Table 7.25).

TABLE 7.25

Weight change in mothers according to feeding type

Feeding type	Lost Weight		Stayed Same		Gained Weight	
	N	%	N	%	N	%
Breast	4	14	18	55	9	31
Bottle	4	66	2	33	0	0
Mixed	0	0	0	0	3	100

It is possible that the WHO recommended level for lactating mothers is high for Saudi respondents who were often inactive during postpartum and the energy data represents a technical rather than a real inadequacy in the diet.

The majority of all respondents at both visits attained the recommendations for protein intake. They had a mean protein intake at both visits (78.6 ± 3.3 at 1st visit and 73 ± 21 at 2nd visit) higher than the recommended level; however, no significant difference between the means was found and not all protein in the mothers' diets was of good quality and digestibility.

The average intake of protein of lactating mothers was only found to be statistically different from that in mothers with bottle fed babies at 1st visit ($p<0.01$). The lactating mothers had a higher mean intake of protein (82.8 ± 32) than the bottle feeders (47 ± 27), which suggests that Saudi lactating mothers still adhered to food beliefs and traditional ideas which tend to boost their consumption of high protein foods, milk/milk products, etc.

The Saudi diet at the 1st visit provided higher mean intake of carbohydrate for all mothers (175.6 ± 64) than it did at the 2nd visit (158.8 ± 67) and the difference between the means was statistically significant ($p<0.04$). A similar relationship was also found between lactating mothers at 1st and 2nd visits ($p<0.01$). Mothers who breast fed at the 1st visit were more likely to have higher mean intake of carbohydrate (176 ± 60) than those at 2nd visit (154.5 ± 69.5). However, no significant difference in mean intake of fat between the lactating at both visits existed.

The proportion of total energy intake derived from protein and carbohydrate at 1st and 2nd visits was 24 ± 14, 25 ± 12 and 36.7 ± 11, 35 ± 9 respectively.

In both visits the diets did not appear to meet the Recommended Dietary Intakes of most vitamins (thiamin, niacin, riboflavin, B_{12}, B_6, vitamins A and C), fibre, iron and calcium. There was no significant difference in mean intake of previous vitamins, minerals and fibre between lactating mothers in 1st and 2nd visits except for B_6 ($p<0.00$). Mothers who breast fed were more likely to have higher mean intake of B_6 in 1st visit than 2nd visit, which indicates that postpartum mother tended to consumer more food with high content of B_6; e.g. meats, liver, in accordance with the belief that these foods are nutritious and compensate for blood loss during delivery.

7.10. Summary

Postpartum and lactation in Saudi Arabian society is still governed by rules which are often transmitted from one generation to another. A mother after delivery is considered to be in a cold state and certain practices regarding clothes, rest and diet were followed.

Dietary beliefs and practices during these critical periods give an impression of adherence to customs and traditional ideas, including hot/cold system, among Saudi respondents, in order to protect health and regain strength. Delivery in hospital might delay these practices one to three days as a normal stay for health mothers. However, the consistency between food beliefs during postpartum and lactation and practice at those two periods showed that respondents did not always practise what they preached in relation to certain foods, particularly to fruits and vegetables, as the meal pattern showed. This might be due to the 24-hour dietary recall representing mothers' actual food intake 4 weeks of delivery and it is possible that mothers usually practise these food beliefs during the first weeks after delivery.

Similar food beliefs were found between pregnant mothers' intentions and studied postpartum respondents, except that aseeda was the first priority for the former group, while fenugreek was for the latter.

An adequate diet for mothers during these critical periods is very necessary because their extra nutritional requirements need to be met for their own health and well-being of their infants. Diet of the majority of all mothers and mothers with breast or bottle at both visits were technically inadequate as compared to FAO/WHO recommendations concerning levels of energy and nutrients, except for niacin, vitamin B_6, vitamin C, calcium and protein intake due to the consumption of foods with a high content of these nutrients; e.g. milk/milk products, eggs, mixed dishes, meats, liver, fruits, vegetables. However, these recommended intakes for energy may be high even for lactating mothers, especially since Saudi respondents were inactive during postpartum and even working mothers (16%) enjoyed 8 weeks' leave on full pay.

However, even considering the limitations of the results, the adequacy of the diet regarding thiamin, riboflavin, vitamin A, iron and fibre arouses some concern, particularly as most of these women were breast feeding their babies and the volume and composition of her milk will be affected by the mother's dietary intake. Other women were within the fertile age and some of them had a large family which might put their health and nutritional status at risk.

CHAPTER VIII

PATTERNS OF INFANT FEEDING

8.1. Introduction

Breast feeding of infants is a natural way of feeding in traditional societies. However, in the past decades the exposure of many traditional cultures to western influences has eroded this practice by introducing bottle feeding and canned baby foods into these cultures. Nowadays, the available evidence of the role of breast feeding in protecting the infant from infections and diseases, as well as the well known advantages of breast milk in terms of nutritive value, contraceptive effect, economics and convenience, are recognized particularly for infants in developing countries, where the standards of hygiene and income are generally low. The trend away from breast feeding is beginning to reverse in western countries, particularly among educated women (Zurayk and Shedid, 1981). Socioeconomics and health of the mothers and child are also other factors which may have an effect on the infant feeding practices.

This study explored patterns of breast and bottle feeding and reasons for mother's choice concerning these, as well as the introduction of solids.

Growth is usually considered a key indicator of health in infants and is influenced by environmental factors such as nutrition, socioeconomic conditions, infection, maternal efficiency, which are eminently changeable, while biological factors like genetics, race, climate are comparatively immutable (Waldmann, 1976). In this first study data on the infants was collected longitudinally and differences in feeding methods as well as other factors examined.

Many studies have reported differences in the mothers' anthropometric measurements in relation to the type of feeding (Richies and Naismith, 1975; Asha Bai *et al.*, 1980; Newman *et al.*, 1980), while other studies showed no influence of feeding method on the mother's weight and body fat (Manning-Dalton and Allen, 1983; Illingworth *et al.*, 1986).

In this chapter the focus will be on the factors influencing infant feeding practices, in addition to the effects of feeding type on the mothers' anthropometric measurements; while the growth patterns observed in these infants and comparison to international reference will be given in Chapter IX.

8.2. General Description of Infants

In this study 51 infants were followed up for nine months. During this period at 1, 3, 6 and 9 months data was collected concerning infant feeding practices and growth patterns. Birth data, health conditions and anthropometric measurements at birth were collected from their delivery records (Table 8.1).

TABLE 8.1

Infants' characteristics

	N	%
Sex		
Male	25	49
Female	26	51
Total	51	100
Birth weight (kg)		
≤2.5	5	10
>2.5	46	90
Range	2.0 - 4.6	-
Mean	3.2 ± 0.5	-
Total	51	100
Birth length (cm)		
≤50	38	74
>50	13	26
Range	45 - 57	-
Mean	49.3 ± 2.0	-
Total	51	100
Birth head circumference (cm)		
≤35	46	90
>35	5	10
Range	29 - 37	-
Mean	33.0 ± 1.7	-
Total	51	100

Among the 51 infants, 49% were males and 51% females. The average birth weight for both sexes was 3.2 ± 0.5 kg. The majority of babies (90%) weighed between 2.501 and 4.600 kg and of them 45% were above 3.250 kg. Ten percent of all babies weighed 2.500 kg and less.

Males tended to be slightly heavier (3.3 ± 0.6 kg) than females (3.0 ± 0.4 kg), but the difference was not statistically significant. However, male babies (49.9 ± 2.4 cm) were significantly ($p<0.04$) taller than female babies (48.7 ± 1.6 cm). No significant association was found between infants' characteristics and socioeconomic status or mothers' characteristics is due to smaller number of the infants.

8.3. Patterns of Infant Feeding

In Saudi Arabia babies are often breast fed at birth. They are usually given a few sips of water and then ghee or a few drops of castor oil to lubricate the gut (Sebai, 1981; Abdulla *et al.*, 1982). However, the practice of giving ghee or oil was not reported amongst the study mothers, probably because all deliveries occurred in the hospital. The majority of babies (82%) were given glucose solution during the first six hours after delivery, whereas others were put to the breast (12%) or bottle (2%) and only 4% (2) of mothers did not know what was the first food given to their babies.

Different reasons were mentioned by mothers for giving glucose solution to babies, such as "to make baby ready for milk" (57%), "clean baby's gut" (38%) and "easy to digest" (2%). Only 2% could not suggest a reason behind this practice. All mothers who breast fed within the first 6 hours gave "tradition" as the reason for this, while those who bottle fed during this period cited "lack of breast milk" as the reason. Clearly these mothers had never intended to breast feed.

Most mothers (55%) stayed only one day at hospital, others stayed 2 days (33%) or three days (12%). Ninety-four percent of the mothers had their babies with them in the same room. The actual feeding pattern of the 51 study infants is presented in Table 8.2.

TABLE 8.2

Milk feeding patterns of Saudi infants

	1st visit (1 month)		2nd visit (3 months)		3rd visit (6 months)		4th visit (9 months)	
	N	%	N	%	N	%	N	%
Breast only	38	74	31	61	28	55	28	55
Bottle only	6	12	9	17	14	27	15	29
Mixed	7	14	11	22	9	18	8	16

The prevalence of breast feeding among Saudi mothers was greater at 1, 3, 6 and 9 months than other feeding methods (bottle and mixed), with a noticeable decline in the percentages of breast fed babies as their ages increased, but the difference was not statistically significant.

Others have found that feeding intentions during pregnancy are a good prediction of actual feeding practices. When the results from the follow-up study were compared with the feeding intentions of pregnant mothers from Study II, it was found that these were very similar in these two groups of mothers. That is 72%, 19% and 9% of the pregnant subjects intended to breast, bottle and mix feed their babies, respectively.

Mothers who breast fed at first visit felt breast feeding should continue for an average period of 24 months. The reasons behind this period are stated in Table 8.3.

TABLE 8.3

Reasons for prolonged breast feeding among Saudi mothers

Reason	N	%
Islamic teaching	20	53
No breast milk after that period	5	13
Prevent pregnancy	5	13
Baby old enough	5	13
Good for baby health	2	5
Comfort for mother	1	3
TOTAL	38	100

The most common overall reason was Islamic teaching which recommends the duration of breast feeding for 2 years. However, in this study only 53% gave it as a reason. Modernization, commercialism and high incomes may be responsible for this change.

The average numbers of breast and bottle feeds per day are presented in Table 8.4.

TABLE 8.4.

Average number and the range of feeds per day

	1st visit	**2nd visit**	**3rd visit**	**4th visit**
Breast	9 (7 - 12)	8 (6 - 11)	6 (4 - 9)	5 (4 - 7)
Bottle	6 (5 - 8)	7 (6 - 10)	5 (4 - 6)	4 (3 - 7)

Bottle fed babies seemed to be fed less frequently. The reliability of mothers' replies is not known; however, since many mothers at first (94%), second (98%), third (98%) and fourth (98%) visits reported feeding their babies on demand, it may have been difficult for them to give a precise number of feeds per day.

There are different kinds of milk formulae available in Saudi Arabia. All mothers who bottle fed their babies used powder formula and only 7 different brands were used by them, as shown in Table 8.5.

TABLE 8.5

Brands of milk formula used by mothers at different ages

Milk brand	1st visit (1 month)		2nd visit (3 months)		3rd visit (6 months)		4th visit (9 months)	
	N	%	N	%	N	%	N	%
Nan	7	54	7	35	5	22	4	17
S26	2	15	4	20	4	17	4	17
Similac	4	31	7	35	8	35	8	35
Isomail	0	0	1	5	1	4	1	4
Guigoz	0	0	1	5	1	4	1	4
Nectare	0	0	0	0	1	4	1	4
Nido	0	0	0	0	3	13	4	17
Total mothers using baby milk	13	100	20	100	23	100	23	100

Nan and Similac were the most popular brands at all ages. Nido is another powdered milk which is not recommended for infants under one year; however, of those mothers using commercial milks 13% and 17% used it at six and nine months of age respectively.

Milk formulae were usually bought by the respondent's husband at all visits and feeds were made as needed. All mothers fed their babies while holding them and any extra milk was disposed of after the feed.

8.3.1. Reason for Milk Feeding Practices at First Visit

As Table 8.6 shows, nutrition, natural and strong binding was the major reason cited by mothers (82%) who breast fed. This was also mentioned previously by pregnant women discussing their feeding intentions (62%), but by fewer of them; while insufficient or no breast milk were the major reasons reported by mothers who bottle (66%) and mixed (86%) fed their babies, respectively. Those reasons were also mentioned by the pregnant women in Study II when asked about their intentions, but the percentages were lower (53% for bottle fed, 54% for mixed fed).

TABLE 8.6

Reasons for milk feeding practices at first visit

Reasons	**First Visit**					
	Breast		**Bottle**		**Mixed**	
	N	**%**	**N**	**%**	**N**	**%**
Natural, nutritious and makes strong relationship	31	82	0	0	0	0
Enough milk	4	10	0	0	0	0
Islamic teaching	2	5	0	0	0	0
Not to be pregnant	1	3	0	0	0	0
Bottle better than breast	0	0	1	17	0	0
Insufficient or no breast milk	0	0	4	66	6	86
Baby refused breast	0	0	1	17	0	0
Work or study	0	0	0	0	1	14
TOTAL	38	100	6	100	7	100

Although the most common reason cited for choosing bottle feeding was lack of breast milk, it is unlikely that all these mothers (4) represent real quantitative or qualitative deficiencies in milk supply. More likely few mothers may choose bottle feeding because of fear that their infant is not receiving sufficient milk, or a desire to fatten the infant. Furthermore, many factors may contribute to unsuccessful lactation, including inadequate knowledge of establishing lactation, hospital practices delaying the first feedings and the psychological impact of the availability of a wide variety of milk formulae (Harfouche, 1982).

Other studies have shown that past experience and the number of other children may affect choice of feeding method. However, breast feeding was so common amongst these mothers that it was not possible to show any influence from these factors. There is also some evidence that how a mother was fed while she was a baby may influence the choice of feeding pattern of her infant (WHO, 1981). Seventy-two percent of all mothers in this study followed the same feeding method with their children as they were fed when they were babies. These results illustrate the trend away from breast feeding, for while 97% of them were breast fed themselves, only 74% were breast feeding their own infants.

8.3.2. Reasons for Changing Milk Feeding Practices at Second, Third and Fourth Visits

Over time some mothers abandoned exclusive breast feeding and changed to mixed or exclusive bottle feeding; sometimes in the sequence breast only - mixed breast and bottle - bottle only. The reasons for changing are shown in Table 8.7.

TABLE 8.7

Reasons for changing milk feeding practices at second, third and fourth visits

Reasons	2nd visit		3rd visit		4th visit		Total	
	N	%	N	%	N	%	N	%
Breast milk not enough	7	54	3	43	1	100	11	52.4
Back to work	3	23	0	0	0	0	3	14.3
Baby sick	2	15	1	14	0	0	3	14.3
Use contraceptives	1	8	3	43	0	0	4	8.0
TOTAL	13	100	7	100	1	100	21	100.0

Mothers gave "breast milk not enough" as the most common reason for changing at second (54%), third (43%) and fourth (100%) visits. Returning to work was the reason given by an unexpectedly high number of mothers at the second visit. This contrasts with the findings of other researchers (Rahman *et al.*, 1982). They found that only 4% of Saudi mothers in Dammam stopped breast feeding to resume employment. At the third visit (6 months) the reason for abandoning breast feeding was as likely to be use of oral contraceptives as inadequate milk supply. This is due to a common belief among mothers that using oral contraceptives will reduce milk production and change its taste, which may affect the infant's growth. The same reason was also reported by Rahman *et al.* (1982) that 19% of Saudi mothers in the Eastern province of the kingdom stopped breast feeding either to use oral contraceptives or to return to work.

8.3.3. Source of Advice about Infant Feeding

As can be seen from Table 8.8, previous experience was the most common source of advice which helped mothers in choosing the feeding method for a new child. Other popular sources for advice were doctor (20%) and respondent's mother (13%).

Interestingly, the media (10%) did also play an important role in the mother's decision concerning infant feeding. For the 11 first-time mothers involved in this study, their family (mother 3, husband 1) was the most common source for advice. Other sources for them were observation (3), media (2) and their knowledge (2).

TABLE 8.8

Source of advice sought about infant feeding

Source	1st visit	
	N	%
Media (TV, press)	5	10
Doctor	10	20
Islamic teaching	1	2
Previous experience	21	41
Observation	3	6
Respondent's knowledge	2	4
Respondent's husband	2	4
Respondent's mother	7	13
TOTALS	51	100

8.3.4. Supplementary Foods

In this study, about a third of mothers (33%) were giving their babies aged 1 month liquids at the first interview - water with sugar (41%), baby tea (29%), anise water (18%), water of soaked dates and fruit juice (6%). But supplementary foods are usually considered to be any solid foods given to infants in addition to either breast milk or formula.

The introduction of the first solid food commenced between the ages of 2-5 months; however, they were most commonly introduced at 4 months (Table 8.9).

TABLE 8.9

Introduction of solid foods, type and age of infant

	2 months		3 months		4 months		5 months		Total	
	N	%	N	%	N	%	N	%	N	%
% given solids of all infants	5	10	19	37	22	43	5	10	51	100
First foods introduced										
Cereal & biscuits	3	60	14	74	18	81	4	80	39	76
Fruits in jar	0	0	1	5	2	9	1	20	4	8
Home made fruits	0	0	3	16	1	5	0	0	4	8
Home made vegetables	2	40	0	0	0	0	0	0	2	4
Half-cooked yolk of egg	0	0	1	5	1	5	0	0	2	4
TOTAL	5	100	19	100	22	100	5	100	51	100

This timing was similar to the reported intentions of the pregnant women in Study II. This finding did not correspond with Sebai's survey (1984) in that most Saudi mothers introduced the first solid food to children later, at the age of 6 to 9 months in settled, semi-settled and nomadic communities. Saudi infants who were bottle fed were more likely to receive solid food earlier than those who were breast fed. This gradual decline in breast feeding and an increase in the introduction of formula accompanied by earlier feeding of solids could contribute to diarrhoeal disease when hygiene is poor, or may lead to infant obesity, particularly since commercial foods are popular in the Saudi community and contain higher calories. The latter situation has been observed also in industrialized and transitional countries.

Commercial foods, cereals (cerelac, baby rice) and biscuits (Farley's rusks) were the most popular choice (76%) for infants as first solid food at all ages and were most (81%) commonly given at the age of 4 months. They were also commonly mentioned by pregnant subjects as first choice for weaning foods, albeit by a lower percentage of mothers (49%). Cereals and biscuits were mixed either with water or formula milk.

Other supplementary foods given to infants were fruits in jar (8%), home made fruits (8%), home made vegetables (4%) and half cooked egg yolk (4%). Most of these foods were introduced at 3-5 months of age; however, home-made vegetables were given earlier at the age of 2 months (Table 8.9).

Other food groups, such as milk products (creamy cheese, mahalabia, yoghurt) and protein foods (meat sauce, lentil soup) were both first offered to infants at the age of six months by 12% and 49% of respondents respectively. Boiled rice or bread were usually soaked in meat sauce before giving to the infant.

At both the second and third visits, mothers who had newly introduced solid foods were most likely to have done so using a spoon. However, mothers introducing solids by the age of 3 months (2nd visit) were more likely to have put the food into the bottle (19%) than mothers at the third visit (6 months, 9%). The bottle was used mostly for watery cereals and juices. When these results were compared to pregnant subjects in Study II, it was found that 22% of women planned to add food to the bottle. The type of foods to be used were similar - cereals, fruit juices, vegetable soups and milk formula with egg.

8.3.5. Cessation of Breast Feeding

Whether cessation of breast feeding occurs gradually or abruptly may have a different effect on the infant. It is generally agreed that gradual weaning is the best method for the infant in order to adapt to new foods. Abrupt weaning may be dangerous for the infant and is often associated with a higher rate of infections, particularly diarrhoeal disease and malnutrition. Weaning starts at different times in different communities. In this study all mothers had started by 6 months and a substantial proportion of them (32%) started by 3 months. In the United Arab

Emirates the percentage of infants who were weaned at less than 3 months ranged from 19-35% (Ali, 1981) and this early weaning could be due to the availability of imported weaning foods on the market. Mothers find them more convenient to prepare than home-made weaning foods and this encourages their use. The majority of respondents (82.8%) weaned their babies gradually, while the remainder weaned abruptly. Mothers were asked when they expected to cease breast feeding completely and the reasons reported varied at different ages, as shown in Table 8.10.

TABLE 8.10

Reasons for completely ceasing breast feeding[a]

Reason	9 months (n=1)		12 months (n=7)		14 months (n=1)		18 months (n=4)		24 months (n=17)	
	N	%	N	%	N	%	N	%	N	%
Baby old enough	0	0	7	100	1	100	3	75	3	17.6
New pregnancy	1	100	1	14.3	0	0	1	25	2	11.8
Doctor's advice	0	0	1	14.3	0	0	0	0	0	0
Islamic teaching	0	0	0	0	0	0	0	0	12	70.6

n=29

[a] Each column adds up to more than 100 percent because one respondent could give more than one answer.

"Baby old enough" was the most common reason for planning to complete breast feeding at the age of 12 and 14 months; while Islamic teaching was the most popular reason at the age of 24 months. This finding does not agree with the results of the WHO study on contemporary patterns of breast feeding (1981) in which insufficient breast milk was the most common reason for stopping breast feeding. Some mothers (6) planned to use special methods to keep the child away from the breast, in addition to introducing other food gradually. The methods suggested were rubbing the breasts with quinine (3) or with pepper (1) or with coffee (1) and hiding the breast from the child (1) were intended to be used for finally ceasing breast feeding.

8.3.6. Sterilization and Preparation of Formulae

All mothers who bottle fed their babies reported washing the bottle before using it for the next feed (Table 8.11), but only about one-half of the mothers (54%) who were bottle feeding at the first visit sterilized the bottle.

TABLE 8.11

Sterilization and preparation of formulae

	1st visit (n=13)		2nd visit (n=20)		3rd visit (n=23)		4th visit (n=23)	
	N	%	N	%	N	%	N	%
Washing bottle after each use	13	100	20	100	23	100	23	100
Sterilizing bottle feeding								
Yes	7	54	13	65	16	70	16	70
No	6	46	7	35	7	30	7	30
Boiling water								
Always	9	69	14	70	19	83	19	83
Never	4	31	6	30	4	17	4	17

At later visits mothers were more likely to sterilize, but this never rose above 70%. In addition mothers who were bottle feeders at the first visit were less likely to boil the water than at the later visits, when the percentage of mothers who boiled the water increased to 83%. Contaminated milk could cause infection and diarrhoea which in turn aggravates malnutrition in the infant.

8.4. Diarrhoea and its Treatment

It is generally accepted that diarrhoeal disease is associated with maternal ignorance or neglect of basic hygiene, the quality of the family's drinking water, and a variety of other environmental factors. Episodes of diarrhoea were most commonly reported at 6 months, by which time all of the mothers had introduced solid food.

Most of these infants had diarrhoea for 1-2 days. However, 29% of infants who had diarrhoea at 6 months of age had suffered from this for a long period (7-8 days), as mentioned by their mothers (Table 8.12). Diarrhoea itself frequently leads to malnutrition owing to low food intake.

In comparison with other age groups, infants aged 6-9 months had the highest incidence of diarrhoea during the period of the study. It has been reported in a survey done by Al-Sekait (1988) that Saudi children at age 6-23 months had the highest risk of diarrhoeal disease. This could be due to the immaturity of the immune system in conjunction with the decline in passive immunity and the exposure to diarrhoeal agents at this age.

TABLE 8.12

Episodes of diarrhoea reported at each visit

	1st visit		2nd visit		3rd visit		4th visit	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Diarrhoea								
Yes	12	23	10	20	17	33	14	28
No	39	77	41	80	34	67	37	72
Length of Episode (days)								
	(n=12)		(n=10)		(n=17)		(n=14)	
1-2	6	50	4	40	10	59	11	79
3-4	3	25	2	20	2	12	2	14
5-6	2	17	2	20	0	0	0	0
7-8	1	8	2	20	5	29	1	7

Practices concerning the treatment of diarrhoea are varied (Table 8.13). Infants with diarrhoea at age of 1 month were given breast milk only (33%), while others at ages of 3 (40%) and 6 (29%) months were given breast milk with doctor's prescription. However, different treatments were used at the age of 9 months such as breast milk with doctor's prescription (21.3%), breast milk with tea (21.3%), formula with doctor's prescription (21.3%) and tea with doctor's prescription (21.3%). In most instances the prescription included oral rehydration therapy. No mothers reported restricting fluids during episodes of diarrhoea.

TABLE 8.13

Methods of diarrhoea management

	1st visit		2nd visit		3rd visit		4th visit	
	N	%	N	%	N	%	N	%
Treatment of diarrhoea	(n=12)		(n=10)		(n=17)		(n=14)	
Breast milk only	4	33	2	20	0	0	1	7.1
Bottle milk only	0	0	0	0	0	0	0	0
Breast + doctor's prescription	3	25	4	40	5	29	3	21.4
Bottle + doctor's prescription	3	25	2	20	1	6	3	21.4
Tea + doctor's prescription	0	0	0	0	1	6	3	21.4
Rice water + doctor prescription	0	0	0	0	2	12	0	0
Breast + tea	1	8	0	0	1	6	3	21.4
Bottle + tea	1	8	1	10	2	12	0	0
Breast + rice water	0	0	1	10	2	12	0	0
Bottle + rice water	0	0	0	0	1	6	1	7.1
Breast + mashed banana	0	0	0	0	2	12	0	0

Infants were treated for diarrhoea at different places and this might depend on the degree of severity. Home was the common place at first (50%) and third (41%) visits, while health centre and hospital were the common ones at second (40%) and fourth (57%) visits (Table 8.14).

TABLE 8.14

Place of diarrhoea treatment

	1st visit		2nd visit		3rd visit		4th visit	
	N	%	N	%	N	%	N	%
Treatment place	(n=12)		(n=10)		(n=17)		(n=14)	
House	6	50	1	10	7	41	5	36
Private clinic	2	17	3	30	4	24	0	0
Hospital	3	25	2	20	6	35	8	57
Health centre	1	8	4	40	0	0	1	7

8.5. Factors Affecting Incidence of Diarrhoea

Diarrhoeal diseases represent one of the major public health challenges to developing countries, where they are the leading cause of death in children under 5 years. Factors affecting the incidence of diarrhoea are complex; however, in this study, the effect of type of feeding and mother's characteristics will be examined in relation to prevalence of diarrhoeal diseases (Table 8.15).

The presence of diarrhoea was commonly found among infants who were bottle fed as compared to others who were breast or mixed fed, particularly at the first three visits; whilst at the fourth visit diarrhoea was more commonly found among infants who were mixed fed than the others. This result was also found by Al-Sekait's survey (1988). He reported a significant association ($p<0.05$) between bottle milk feeding and diarrhoeal incidence.

As for other factors, it was found that at the first visit there was a tendency for diarrhoea to be more commonly reported among mothers who were illiterate, older, lived in rented accommodation and had 1-5 children. At the second visit, although those who were illiterate and lived in rented accommodation were still more likely to report diarrhoea, the picture was reversed in relation to age and number of children. At the third and fourth visits, the picture also changed with regard to literacy and accommodation.

Although lack of education was not consistently linked with diarrhoea in this sample, it was at both the first and second visits when the infant is most vulnerable and this indicates the need for education amongst illiterate mothers in Saudi Arabia, even those who have a relatively comfortable lifestyle.

TABLE 8.15

Factors influencing diarrhoea incidence

	1st visit (1 month)				2nd visit (3 months)				3rd visit (6 months)				4th visit (9 months)			
	Yes		No		Yes		No		Yes		No		Yes		No	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Type of Feeding																
Breast	(7)	18	(31)	82	(7)	23	(24)	77	(9)	32	(19)	68	(5)	18	(23)	82
Bottle	(3)	50	(3)	50	(3)	33	(6)	67	(5)	36	(9)	64	(5)	33	(10)	67
Mixed	(2)	29	(5)	71	(0)	0	(11)	100	(3)	33	(6)	67	(4)	50	(4)	50
Mother's Age (years)																
18 - 20	(1)	8	(12)	92	(3)	23	(10)	77	(4)	31	(9)	69	(3)	23	(10)	77
21 - 46	(11)	29	(27)	71	(7)	18	(31)	82	(13)	34	(25)	66	(11)	29	(27)	71
Number of Living Children																
1 - 5	(9)	25	(27)	75	(6)	17	(30)	83	(14)	39	(22)	61	(11)	31	(25)	69
6 - 12	(3)	20	(12)	80	(4)	27	(11)	73	(3)	20	(12)	80	(3)	20	(12)	80
Mother's Education																
Illiterate	(7)	35	(13)	65	(6)	30	(14)	70	(6)	30	(14)	70	(4)	20	(16)	80
Literate	(5)	16	(26)	84	(4)	13	(27)	87	(11)	35	(20)	65	(10)	32	(21)	68
Type of Accommodation																
Owned	(5)	19	(21)	81	(4)	15	(22)	85	(11)	42	(15)	58	(7)	27	(19)	73
Rented	(7)	32	(15)	68	(6)	27	(16)	73	(5)	23	(17)	77	(4)	18	(18)	82

8.6. Anthropometric Measurements of Saudi Mothers and the Effects of Feeding Method

During pregnancy there is an increase in weight of fat and lean tissues of the mother which is apart from the products of conception. The amount of fat stored depends on the diet taken by women (Whitehead *et al.*, 1986). This stored energy is to support the energy demands of lactation; however, lactational performance is not affected when there is little or no fat deposited during pregnancy (Whitehead *et al.*, 1986).

In some studies it was found that lactating mothers decreased both body weight and maternal fat, while non-lactating mothers increased fat reserves. This may be due to the combination of normal activity and energy needs exceeding their energy intake during lactation (Habich *et al.*, 1972; Butte *et al.*, 1984; Delgado *et al.*, 1985). Other studies have also shown that there is a decline in energy expenditure during lactation (Illingworth *et al.*, 1986) which might, in addition to maternal fat stores, contribute as a factor in supporting lactation. However, all those previous studies assume that the changes in body weight and fat are the result of lactation.

In this study only mothers who never changed the feeding type during the study period were examined in relation to their body weights and skinfold thickness. Mothers' heights in the study (152.6 ± 5.0) were not significantly different from Study II (153.7 ± 4.9) and were used to calculate body mass index (BMI). In this study mothers who breast fed were more likely to have lower mean body weight, skinfolds (biceps, triceps and subscapular) and body mass index, as compared with mothers who bottle and mixed fed at each of the four visits (Tables 8.1A, 8.2A, 8.3A, 8.4A & 8.5A). However, a test of multivariate analysis of variance which was used to detect the variation in mothers' anthropometric measurements in relation to feeding type across the four visits, showed no significant difference. Therefore the results indicate that there were no major significant differences in maternal body weights and skinfold thickness related to infant feeding method.

However, mothers with a higher mean body mass index (BMI) were more likely to be older (21-46) and have higher number of children (>6), which is a pattern commonly found.

8.7. Summary

All the study mothers were delivered in hospital, which might delay or stop special practices such as giving sips of water or oil or ghee to infants, as reported in other studies. However, glucose solution was given to the majority of infants which 57% of mothers believed made them ready for the milk. Babies were kept in the same room with their mothers, unless they were sick.

The mother's decision to breast feed or not may be influenced by many factors such as religion, tradition, work, socio-economic conditions, modernization, commercialism and health care system. In the past all mothers breast fed their babies for almost 2 years according to Islamic teachings. However, a decline in the prevalence and duration of breast feeding has been observed among Saudi mothers from first to fourth visit with an increase in bottle feeding towards the end of the study. These findings are in line with results from other researchers (Lawson, 1981; Sawaya *et al.*, 1987). Natural, nutritious and creating a strong bond between the mothers and their babies was the most common reason for breast feeding, while no breast milk or insufficient breast milk were the reasons for bottle and mixed feeding. The common source of advice for infant feeding appears to have been related to whether a mother had previous experience or not. However, for primiparas their mother was the common source of knowledge and advice.

Seven different brands of milk formula were used by mothers. Methods of preparing the milk formula varied from one brand to another, some involved difficult measurements and complicated directions about dilution, which mothers were unable to understand easily, especially since 33% of the bottle feeding mothers were illiterate. Morley (1973) reported that since mothers with poor literacy fail to understand the instructions on the tin, they run the risk of making up over diluted milk which does not meet the needs of the infant regarding energy and nutrients, leading to malnutrition and poor infant growth.

Early introduction of first solids was observed in this study, which might lead to increased risk of diarrhoea or early obesity. All the mothers had started introducing supplementary foods by the age of 6 months. Commercial foods, cereals and biscuits were the most common food given to infants at the age of 4 months. This finding supports results from other studies in Saudi Arabia (Al-Othaimeen, 1986).

The weaning process was started gradually by the majority of mothers. "Islamic teachings" and "baby old enough" were the common reasons for stopping breast feeding. Some mothers planned to cease breast feeding completely at two years of age or after because they believed that this period would make the ties between the child and family members closer and stronger. This finding did not correspond with Al-Othaimeen's report (1986) that most mothers in Dammam weaned their babies completely because of new pregnancy. A gradual introduction of solid food to the baby was the correct method for weaning used by most mothers. Some mothers used, in addition to that, different substances to paint the breast in order to keep the baby away from it.

Washing and sterilizing the feeding bottle and boiling the water for milk preparation were followed by the majority of the mothers. Poor hygiene in bottle feeding practice could lead to diarrhoea which was common among bottle fed infants. This might be due to ignorance of elementary hygiene since 33% of bottle feeders were illiterate.

Diarrhoea was commonly found among infants at the age of 6 months, since by this time all mothers gave solid foods to their children. Treatment of diarrhoea was varied, but was usually appropriate, involving increase of fluids and use of ORT. Infants were treated at places depending on the degree of seriousness of the episode.

Pellett (1977), examining infant feeding practices in Libya, considered that Jelliffe's (1976) classification of infant feeding patterns needed expansion in newly rich developing countries to include a group of mothers who were "urban - uneducated - relatively well to do". The mothers in this study would appear to fall largely into this grouping. Educational progress, particularly of women, may not have kept pace with material progress - so that the well documented risks of changing feeding patterns amongst the urban poor, such as overdilution, may be absent; but there is still a trend away from prolonged breast feeding towards bottle feeding and earlier introduction of solids, which can put infants at risk of diarrhoea in the absence of adequate knowledge of hygiene. Perhaps also these mothers were relatively well-off and well-fed; the effect of feeding method on mothers' anthropometric measurements was not significant.

CHAPTER IX

INFANT GROWTH

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9.4. Summary

9.1. Introduction

Body measurement constitute a relatively simple assessment procedure that is useful in nutritional screening. Since physical measurements are partially dependent upon nutrient intake, they are of help in assessing nutritional status. In children a fall-off or an acceleration in the rate of gain in both weight and height is a sensitive indicator of malnutrition (wasting and stunting) which may be due to either inadequate or excessive food intake, and of underlying disease conditions. In addition to food intake, genetic and environmental factors influence growth and development. However, nutrition is one of the critical factors as evidenced by a significant dissimilarity in the growth and development of children in developed and developing countries, where there are differences in availability of food (Wellman, 1978; Mostafa, 1979).

Wasting (inadequate weight/length) is a consequence of short-term deprivation leading to failure to gain weight or weight loss. This malnutrition is more prevalent between one and two years of age. It commonly develops due to infections and periods of deficiency in food intake. However, the growth rate can be re-established again, when the reasons behind wasting were eliminated.

Stunting (inadequate length/age) indicates long-term deprivation resulting in a decline in the rate of skeletal growth and sometimes this process may occur concurrently with wasting. Stunting is a slower process which increases over the time up to 24 months of age or more and recovery may be incomplete, causing a permanent deficit in height. Factors such as chronic inadequate dietary intake, poor socio-economic status and repeated infections may lead to stunting.

The most simple measurements to assess the nutritional status of infants are weight and length. Combined indices such as weight for age, length for age, and weight for length are recommended as primary indicators of infant growth (Waterlow *et al.*, 1977). Weight for length is used to assess wasting and determine the present state of nutrition and length for age is an indicator of stunting and past nutrition.

These indicators can be used in comparing the groups of infants studied with a reference population. FAO/WHO have adopted the National Center for Health Statistics (NCHS) growth data for use as an international reference population (WHO, 1983). Data will be presented as mean (with the S.D.) length and weight according to sex and age alone or with feeding patterns, with comparing the data to 50th centiles of NCHS reference. In addition, the distribution of the data is presented according to weight/age, weight/length and length/age according to recommended centiles of NCHS standards, with special reference to stunting and wasting among the infants using Waterlow classification and standard deviation scores.

9.2. Patterns of Infant Growth

9.2.1. Distribution of Mean Weights and Lengths According to Sex and Age of Infants

Mean weights and lengths of 51 Saudi infants, males and females, at different age are shown in Tables 9.1 and 9.2. There was a steady increase of weight with age for both groups, but males were heavier than females of comparable ages and the differences were statistically significant. These findings confirm those of the earlier survey done by Sawaya *et al.* (1985), however the difference in the weight between males and females was small.

As for length, both boys and girls showed also a steady increase in length with age. But boys were significantly more likely to be taller than girls at birth, with a tendency to be taller at ages 1 and 9 months. Also these results were supported by the report of Sawaya *et al.* (1985).

TABLE 9.1

Mean weight/age of Saudi infants

Age (months)	Weight (M ± SD) Males (n=25)	Weight (M ± SD) Females (n=26)	Anova Test F	S.S.
Birth	3.3 ± 0.6	3.0 ± 0.4	3.9	0.05
1	4.2 ± 0.7	3.9 ± 0.4	3.9	0.05
3	6.0 ± 0.9	5.5 ± 0.5	5.9	0.02
6	7.7 ± 0.9	7.1 ± 0.7	6.0	0.02
9	8.9 ± 1.1	8.3 ± 0.9	4.6	0.04

TABLE 9.2

Mean length/age of Saudi infants

Age (months)	Length (M ± SD) Males (n=25)	Length (M ± SD) Females (n=26)	Anova Test F	S.S.
Birth	49.9 ± 2.4	48.7 ± 1.6	4.5	0.04
1	54.5 ± 2.8	53.2 ± 1.6	3.8	0.06
3	60.5 ± 3.4	59.1 ± 2.7	2.7	0.1
6	67.6 ± 2.2	66.9 ± 2.3	1.2	0.3
9	71.5 ± 2.0	70.4 ± 2.8	3.4	0.07

9.2.2. Distribution of Weight for Age of Saudi Infants According to Centiles of NCHS Reference

Distribution of the weight data for males and females for 1-9 months old according to standard percentiles is shown in Table 9.3. From this it is apparent that a half or more of males and females at all ages (except for females at age 3 months) are below the 50th percentile of the reference weight for age. Only about 38% of females at age of three months had weight/age less than median. But, there were very few infants who had weight/age below the 10th percentile. About 6%, 4%, 6% and 18% of infants (sexes combined) had weight/age lower than the 10th percentile weight/age of reference population at one, three, six and nine months respectively.

TABLE 9.3

Distribution of weight for age of Saudi infants according to centiles of NCHS reference

Centile (weight for age)	AGE: 1 month Boys N	%	1 month Girls N	%	3 months Boys N	%	3 months Girls N	%	6 months Boys N	%	6 months Girls N	%	9 months Boys N	%	9 months Girls N	%
0.0 - 9.9	(3)	12	0	0	(1)	4	(1)	4	(2)	8	(1)	4	(3)	20	(4)	15
1.0 - 19.9	0	0	(4)	15	(3)	12	(0)	0	(5)	20	(4)	15	(5)	20	(5)	19
20.0 - 29.9	(1)	4	(5)	19	(2)	8	(3)	11	(5)	20	(3)	11	(1)	4	(1)	4
30.0 - 39.9	(9)	36	(3)	11	(5)	20	(4)	15	(1)	4	(2)	8	(0)	0	(1)	4
40.0 - 49.9	(1)	4	(1)	4	(2)	8	(2)	8	(4)	16	(5)	19	(4)	16	(6)	23
Total <50th Centiles	(14) (56%)		(13) (50%)		(13) (52%)		(10) (38%)		(17) (68%)		(15) (58%)		(15) (68%)		(17) (65%)	
50.0 - 59.9	(3)	12	(4)	15	(5)	20	(3)	11	(1)	4	(3)	11	(1)	4	(1)	4
60.0 - 69.9	(3)	12	(3)	11	(1)	4	(6)	23	(0)	0	(2)	8	(2)	8	(3)	11
70.0 - 79.9	(1)	4	(4)	15	(2)	8	(2)	8	(1)	4	(4)	15	(3)	12	(3)	11
80.0 - 89.9	(2)	8	(1)	4	(0)	0	(4)	15	(5)	20	(1)	4	(4)	16	(1)	4
90.0 - 100.0	(2)	8	(1)	4	(4)	16	(1)	4	(1)	4	(1)	4	(0)	0	(1)	4
Total ≥50th Centile	(11) (44%)		(13) (50%)		(12) (48%)		(16) (62%)		(8) (32%)		(11) (42%)		(10) (32%)		(9) (35%)	
Total	25		26		25		26		25		26		25		26	

9.2.3. Distribution of Length for Age of Saudi Infant According to Centiles of NCHS Reference

Table 9.4 presents the distribution of lengths for age of Saudi females and males in centile compared to the NCHS reference. About half or more than a half of females and males at each age group (except females at age 6 months) had lengths lower than the 50th percentile of reference population. Only 27% of females at age 6 months had length less than 50th centile of standard.

The proportion of infants (combined sexes) with lengths below 10th centile of reference population was 6%, 12%, 8% and 8% at 1 month, 3 months, 6 months and 9 months respectively. These infants may be said to be suffering from at least a mild degree of nutritional stunting. It seems these infants were not well nourished during the first few months of life with growth failure beginning around 1 month and continuing through 9 months with an increase in the percentage of infants who had growth failure at 3 months (12%) and then decrease in the percentage at age of 6 months, with no change at 9 months due to catch up growth of a few infants.

TABLE 9.4

Distribution of length for age of Saudi infants according to centiles of NCHS reference

Centile (weight for age)	AGE: 1 month Boys N	%	Girls N	%	3 months Boys N	%	Girls N	%	6 months Boys N	%	Girls N	%	9 months Boys N	%	Girls N	%
0.0 - 9.9	(2)	8	(1)	4	(3)	12	(3)	11	(2)	8	(2)	8	(1)	4	(3)	11
10.0 - 19.9	(4)	16	(2)	8	(5)	20	(3)	11	(3)	12	(1)	4	(3)	12	(3)	11
20.0 - 29.9	(5)	20	(4)	15	(6)	24	(6)	23	(2)	8	(1)	4	(3)	12	(1)	4
30.0 - 39.9	(0)	0	(6)	23	(1)	4	(0)	0	(3)	12	(2)	8	(7)	28	(0)	0
40.0 - 49.9	(3)	12	(4)	15	(0)	0	(5)	19	(2)	8	(1)	4	(4)	16	(6)	23
Total <50th Centile	(14) (56%)		(17) (65%)		(15) (60%)		(17) (65%)		(12) (48%)		(7) (27%)		(18) (72%)		(13) (50%)	
50.0 - 59.9	(3)	12	(2)	8	(2)	8	(2)	8	(4)	16	(4)	15	(1)	4	(2)	8
60.0 - 69.9	(0)	0	(1)	4	(1)	4	(1)	4	(5)	20	(2)	8	(1)	4	(4)	15
70.0 - 79.9	(4)	16	(3)	11	(2)	8	(1)	4	(3)	12	(5)	19	(3)	12	(1)	4
80.0 - 89.9	(1)	4	(2)	8	(1)	4	(1)	4	(0)	0	(3)	11	(0)	0	(2)	8
90.0 - 100.0	(3)	12	(1)	4	(4)	16	(4)	15	(1)	4	(5)	19	(2)	8	(4)	15
Total ≥50th Centile	(11) (44%)		(9) (35%)		(10) (40%)		(9) (35%)		(13) (52%)		(19) (73%)		(7) (28%)		(13) (50%)	
Total	25		26		25		26		25		26		25		26	

9.2.4. Distribution of Weight for Length of Saudi Infants According to Recommended Centiles of NCHS Reference

Table 9.5 shows the distribution of weight for length in centiles compared to the reference population. More than half of infants (males and females) at age of

6 months and females (54%) at age of nine months had weight for length below the 50th centile of the reference population.

The proportion of infants (combined sexes) who had weight/length below the 10th centile of reference population were 8%, 10%, 23% and 14% at age of one, three, six and nine months respectively, which suggests that in this sample wasting reached a peak at 6 months.

TABLE 9.5

Distribution of weight for length of Saudi infants according to centiles of NCHS reference

Centile (weight for age)	AGE: 1 month Boys N	%	Girls N	%	3 months Boys N	%	Girls N	%	6 months Boys N	%	Girls N	%	9 months Boys N	%	Girls N	%
0.0 - 9.9	(2)	8	(2)	8	(3)	12	(2)	8	(6)	23	(6)	23	(4)	16	(3)	11
10.0 - 19.9	(3)	12	(4)	15	(1)	4	(1)	4	(4)	16	(3)	11	(3)	12	(4)	15
20.0 - 29.9	(3)	12	(1)	4	(2)	8	(2)	8	(4)	16	(4)	15	(2)	8	(2)	8
30.0 - 39.9	(1)	4	(5)	19	(0)	0	(1)	4	(0)	0	(2)	8	(1)	4	(4)	15
40.0 - 49.9	(3)	12	(0)	0	(5)	20	(2)	8	(1)	4	(3)	11	(2)	8	(1)	4
Total <50th Centile	(12) (48%)		(12) (46%)		(11) (44%)		(8) (31%)		(15) (60%)		(18) (69%)		(12) (48%)		(14) (54%)	
50.0 - 59.9	(1)	4	(5)	19	(2)	8	(1)	4	(1)	4	(1)	4	(1)	4	(5)	19
60.0 - 69.9	(2)	8	(4)	15	(2)	8	(5)	19	(3)	12	(3)	11	(5)	20	(1)	4
70.0 - 79.9	(5)	20	(2)	8	(2)	8	(4)	15	(1)	4	(1)	4	(2)	8	(1)	4
80.0 - 89.9	(4)	16	(2)	8	(9)	2	(4)	15	(3)	12	(3)	11	(0)	0	(2)	8
90.0 - 100.0	(1)	4	(1)	4	(6)	24	(4)	15	(2)	8	(0)	0	(5)	20	(3)	11
Total ≥50th Centile	(13) (52%)		(14) (54%)		(14) (56%)		(18) (69%)		(20) (40%)		(8) (31%)		(13) (52%)		(12) (46%)	
Total	25		26		25		26		25		26		25		26	

9.2.5. Prevalence of Wasting and Stunting using Waterlow Classification and Standard Deviation Scores

So far the weight for length and length for age have been considered independently, and the lowest classification point used has been the 10th centile of reference population. An alternative approach is to consider weight for length and length for age based on the percentage deviation from the standard median, which has been used to distinguish between moderate and severe degrees of wasting (acute malnutrition) or stunting (chronic malnutrition). Tables 9.6 and 9.7 show the percentage distribution of weight/length and length/age among infants according to the Waterlow classification (Waterlow and Rutishauser, 1974).

Although moderate or severe wasting was only seen in a small number of infants at each age (Table 9.6), when mild wasting was also included, a degree of wasting was found in 20% of infants at 1 and 9 months, 31% at 6 months and 12% at 3 months. However, Abdullah *et al.* (1982) found a different pattern, a higher percentage of Saudi infants in his survey were wasted at 0-5 months (31%) than at 6-11 months (23.5%).

TABLE 9.6

Weight for length percentage distribution of Saudi infants according to grades of wasting and age (Waterlow classification)

					Grade of Wasting						
Age (months)	Obese (≥110%)		Normal (90-109%)		Mild (80-89%)		Moderate (70-79%)		Severe (<70%)		Total
	N	%	N	%	N	%	N	%	N	%	
1	10	19	31	61	7	14	1	2	2	4	51
3	16	31	29	57	5	10	1	2	0	0	51
6	5	10	30	59	15	29	1	2	0	0	51
9	7	14	34	66	8	16	2	4	0	0	51

It was also noted that a substantial proportion of obese infants were found at each age, but particularly at the age of 3 months (31%).

As for length/age, Table 9.7 shows that no child suffered from severe stunting and only 1 infant showed moderate stunting during the course of this study, at the age of 3 months. At this age the prevalence of mild stunting also reached its peak. Twenty-three percent of infants showed either mild/moderate stunting at 3 months. Abdullah *et al.* (1982) showed prevalence of stunting at 0-5 months. However, these findings are based on a survey of 2 village in Central Saudi Arabia where living conditions were very different and levels of illiteracy and infection much higher.

TABLE 9.7

Length for age percentage distribution of Saudi Arabian infants according to grades of stunting and age (Waterlow classification)

	Grade of Stunting										
Age (months)	**Tall (≥105%)**		**Normal (95-104%)**		**Mild (90-94%)**		**Moderate (85-89%)**		**Severe (<85%)**		**Total**
	N	%	N	%	N	%	N	%	N	%	
1	4	8	43	84	4	8	0	0	0	0	51
3	8	16	31	61	11	21	1	2	0	0	51
6	6	12	41	80	4	8	0	0	0	0	51
9	6	12	41	80	4	8	0	0	0	0	51

Waterlow and others (Waterlow, 1976; Keller *et al.*, 1976) have pointed out the usefulness of looking at the deficit in weight for length (wasting) and the deficit in length for age (stunting) combined together. If a child is below 90% of standard median of length for age, he is considered to be stunted and if he is less than 80% of the standard weight for length he is classified as wasted.

When cross-tabulating weight/length with length/age as 3 x 3 table, a clearer picture of the infant's nutritional status appeared. According to Table 9.8 it seems that the majority (60%) of infants are within the normal range of weight/length at the first visit. Then this percentage declines in the next visit (57%), but rises again to 59% and then to 67% at the third and fourth visits respectively. This pattern is also observed for infants with normal range of length/age.

TABLE 9.8

Weight/length by length/age at first visit

	Wasted		Normal Weight		Over Weight		Total	
	N	%	N	%	N	%	N	%
Stunted	1	2	1	2	2	4	4	8
Normal length	8	16	27	52	8	16	43	84
Tall	1	2	3	6	0	0	4	8
TOTAL	10	20	31	60	10	20	51	100

There was no major nutritional problem observed among infants. However, wasting and stunting existed in a small proportion, with more of the former than the latter, suggesting an acute energy and nutrient deficiency. Only one infant seems to be at greater risk as he is wasted and stunted at the same time. In addition, 20% of the infants were overweight, of these only 2 infants were stunted and overweight and the remainder were overweight but had normal length/age.

In the second visit (Table 9.9) there was an increase in the number of stunted infants (12), but a quarter of them had normal weight (4) and the remainder were overweight (8). No wasted and stunted infants were observed in this visit, although 12% (6) of all infants were wasted. Of these, 5 were wasted and tall and 1 was wasted with normal range of length/age. This reflects the presence of episodes of infection and/or diarrhoea at the time of visit.

TABLE 9.9

Weight/length by length/age at second visit

	Wasted		Normal Weight		Over Weight		Total	
	N	%	N	%	N	%	N	%
Stunted	0	0	4	8	8	16	12	23
Normal length	1	2	22	43	8	16	31	61
Tall	5	10	3	6	0	0	8	16
TOTAL	6	12	29	57	16	31	51	100

At the third visit, the picture of stunting and wasting changed and a higher percentage of wasted infants (31%, 16) appeared than stunted infants (8%, 4) (Table 9.10). This is probably related to the introduction of solids and increased incidence of diarrhoea. Most of the wasted infants (14) were in the normal range of length/age and others were tall (2).

TABLE 9.10

Weight/length by length/age at third visit

	Wasted		Normal Weight		Over Weight		Total	
	N	%	N	%	N	%	N	%
Stunted	0	0	2	4	2	4	4	8
Normal length	14	27	24	47	3	6	41	80
Tall	2	4	4	8	0	0	6	12
TOTAL	16	31	30	59	5	10	51	100

As for the fourth visit, the pattern for wasting changed again with a decline in the number of wasted infants (10). However, wasting was more prevalent among infants than stunting. Only 1 infant was wasted and stunted. Others either wasted with normal length/age (6), or wasted with tall (3).

TABLE 9.11

Weight/length by length/age at fourth visit

	Wasted		Normal Weight		Over Weight		Total	
	N	%	N	%	N	%	N	%
Stunted	1	2	2	4	1	2	4	8
Normal length	6	11	29	57	6	12	41	80
Tall	3	6	3	6	0	0	6	12
TOTAL	10	19	34	67	7	14	51	100

It seems that the majority of infants had normal growth at all ages. The prevalence of wasting and stunting were low among the infants at all ages; however, a higher proportion (31%) of wasted children were found at age 6 months than others, while a higher proportion (23%) of stunted children were found at age of 3 months than others. Both wasting and stunting occurred concurrently at ages 1 and 9 months, but in a very small number of infants. In fact overweight was a more common problem (31%) at the age of 3 months.

Recently, WHO (Keller and Fillmore, 1983) has recommended the use of -2SD of the NCHS reference median length/age and weight/length as cut-offs to identify infants with stunting and wasting respectively. According to this classification, as seen in Tables 9.1A and 9.2A (Appendix IX), the highest rate of stunting (25%) and wasting (31%) was seen in children aged 3 and 6 months respectively.

When stunting and wasting are considered at each visit, a better overall picture of infants' nutritional status at each age can be drawn (Tables 9.3A - 9.6A in Appendix IX).

When a comparison was made using Waterlow's classification and the -2SD criterion, the picture which emerged was almost identical. At the first visit only one child in each case was found to be both stunted and wasted. No such children were found at the second visit. At the third and fourth visits a higher number of children were found to be both stunted and wasted when the -2SD criterion was used. However, the numbers were still very small - only one child, compared with none by Waterlow classification at 6 months, and 2 children compared with 1 at 9 months.

9.3. Factors Influencing Infant's Growth

Growth is an increase in size of the whole body or its parts. It is influenced by several factors such as insufficient or incorrect feeding and diarrhoeal diseases. Repeated severe or chronic infection also interferes with nutrition and hence with growth. It leads to decreased intake, increased losses through diarrhoea, poor absorption and increased needs.

Children may vary in their ability to grow, but growth can be assisted by certain conditions. The socio-economic status is important and affects growth, because it determines to a great extent food availability, education, access to health services, housing, sanitation and water supply, all of which in turn influence the frequency and severity of infections.

Family size can influence growth and development of the infant. Large family size not only affect maternal health and nutrition, but also the amount of food available to each child, the duration of breast feeding and the amount of care given by the mother (Jelliffe, 1985).

9.3.1. Type of Feeding

9.3.1a. Effects of feeding type on the infant's weight, length, head and mid arm circumferences (combined sexes)

The analysis of growth progress in relation to feeding type (breast, bottle, mixed) was determined by the measuring weight, length, head circumference and mid arm circumference at different age intervals (1, 3, 6 and 9 months). There was no significant variation in the mean weight, length, head circumference and mid arm circumference among Saudi infants who were breast fed, bottle fed and mixed fed at each stage. However, these measurements were slightly lower in the mixed fed infants than others (Tables 9.7A, 9.8A, 9.9A and 9.10A in Appendix IX). These findings disagree with the suggestion that infant who were mixed fed were more likely to have higher mean weight and length than infants who were breast fed exclusively, which may be attributed to the advantage of additional calories and nutrients (Vijayalakshmi *et al.*, 1975). Other studies in poor and malnourished populations showed that breast fed infants were considerably longer and heavier than those of bottle or mixed fed infants (Lebstein and Elbahay, 1976; Almorth and Latham, 1982) and this result corresponds with our finding that the former was slightly taller and higher in mid arm circumference than the latter, but that the difference was not statistically significant.

Only a few studies in developing countries such as in Malaysia (Dugdale, 1971) found no differences in the growth of breast and bottle fed infants.

However, in Western populations, exclusively breast fed infants thrive better than the artificially fed infants only during the first three months after birth (Mellander *et al.*, 1959; Jackson *et al.*, 1964), while Beal (1969) reported that weight increment was maximum for the babies breast fed for more than six months from birth. Few studies observed better physical growth of bottle fed infants from 6 weeks of age (Richie and Naismith, 1975).

From the nutritional point of view, breast fed babies have been found to be less likely to develop severe protein-energy malnutrition, anaemia, vitamin A deficiency and dental caries (Graham and Morales, 1963; Wray, 1978; Aldy *et al.*, 1979) than others. However, factors such as environment and socio-economics (e.g. early or delayed or inadequate introduction of supplementary foods, mother's education) have been found to be related to poor growth (Martorell *et al.*, 1984; WHO, 1981).

9.3.1b. Distribution of mean weight and length according to age, sex and infant feeding patterns

In the Tables 9.12 and 9.13 the data shows the mean weights of females and males classified on the basis of feeding method. It was noted that there was overall no significant difference in the mean weight among males who were breast, bottle and mixed fed. However, a tendency ($p < 0.07$) was found among the boys at the age of three months. Breast fed boys were more likely to be heavier than those who were bottle or mixed fed.

As regards the females, no significant difference was found in the mean weight among them at 1, 3, 6 and 9 months. However, bottle fed females were slightly heavier than breast and mixed fed females. These were born with higher mean weight than others, and probably were introduced at an early age to supplementary foods.

TABLE 9.12

Mean weight/age of breast, bottle and mixed fed infants (females) compared with NCHS data (50th centile)

Age (months)	50th centile	Breast N	Breast Mean ± SD	Bottle N	Bottle Mean ± SD	Mixed N	Mixed Mean ± SD	Anova Test F	Anova Test SS
0	3.2	(15)	3.0 ± 0.3	(5)	3.5 ± 0.4	(6)	2.9 ± 0.4	(6.2)	0.01
1	4.0	(14)	3.9 ± 0.4	(5)	4.2 ± 0.2	(6)	3.7 ± 0.5	(2.4)	0.1
3	5.4	(15)	5.5 ± 0.6	(6)	5.8 ± 0.2	(5)	5.3 ± 0.4	(1.4)	0.2
6	7.2	(15)	7.1 ± 0.7	(7)	7.4 ± 0.7	(4)	6.7 ± 0.4	(1.6)	0.2
9	8.6	(15)	8.2 ± 0.9	(8)	8.7 ± 0.9	(3)	7.7 ± 0.7	(1.6)	0.2

TABLE 9.13

Mean weight/age of breast, bottle, mixed fed infants (males) compared with NCHS data (50th centile)

Age (months)	50th centile	Breast N	Breast Mean ± SD	Bottle N	Bottle Mean ± SD	Mixed N	Mixed Mean ± SD	Anova Test F	Anova Test SS
0	3.3	(23)	3.4 ± 0.6	(1)	2.5 ± 0.0	(1)	2.9 ± 0.0	(1.4)	0.3
1	4.3	(23)	4.3 ± 0.6	(1)	3.3 ± 0.0	(1)	4.0 ± 0.0	(1.6)	0.2
3	6.0	(16)	6.3 ± 0.9	(3)	5.9 ± 0.7	(6)	5.4 ± 0.4	(2.9)	0.07
6	7.8	(13)	7.9 ± 1.0	(7)	7.5 ± 0.8	(5)	7.0 ± 0.2	(2.5)	0.1
9	9.2	(13)	9.3 ± 1.2	(7)	8.8 ± 0.8	(5)	8.1 ± 0.4	(2.3)	0.1

In Tables 9.14 and 9.15 the data shows mean length of females and males according to type of feeding. There was no significant difference in mean length among females or males regarding feeding type. However, males who were breast fed were more likely to be taller than those who bottle or mixed fed ($p < 0.07$) at the age of three months.

Overall, males who were breast fed have a tendency to be heavier and taller at the age of 3 months than those who were bottle or mixed fed. This result was supported by other researchers (López *et al.*, 1984) that breast fed infants generally made better weight gains than those who were mixed or bottle fed.

TABLE 9.14

Mean length/age of breast, bottle, mixed fed infants (females) compared with NCHS data (50th centile)

Age (months)	50th centile	N	Breast Mean ± SD	N	Bottle Mean ± SD	N	Mixed Mean ± SD	Anova Test F	SS
0	49.9	(15)	48.7 ± 1.3	(5)	49.4 ± 1.7	(6)	48.3 ± 2.4	(0.6)	0.5
1	53.5	(15)	53.0 ± 1.8	(5)	53.7 ± 1.7	(6)	53.3 ± 1.4	(0.3)	0.7
3	59.5	(15)	59.0 ± 2.2	(6)	59.9 ± 2.9	(5)	58.6 ± 4.1	(0.3)	0.7
6	65.9	(15)	66.0 ± 2.8	(7)	67.6 ± 1.7	(4)	66.2 ± 1.5	(0.4)	0.6
9	70.4	(15)	70.9 ± 3.0	(8)	70.1 ± 2.9	(3)	68.8 ± 2.0	(0.7)	0.5

TABLE 9.15

Mean length/age of breast, bottle and mixed fed infants (males) compared with NCHS data (50th centile)

Age (months)	50th centile	N	Breast Mean ± SD	N	Bottle Mean ± SD	N	Mixed Mean ± SD	Anova Test F	SS
0	50.5	(23)	50.1 ± 2.3	(1)	46.0 ± 0.0	(1)	49.0 ± 0.0	(1.6)	0.2
1	54.6	(23)	54.8 ± 2.7	(1)	51.0 ± 0.0	(1)	51.5 ± 0.0	(1.5)	0.2
3	61.1	(16)	61.7 ± 3.5	(3)	58.2 ± 0.3	(6)	58.7 ± 2.4	(3.0)	0.07
6	67.8	(13)	68.3 ± 2.6	(7)	66.3 ± 1.6	(5)	67.7 ± 0.7	(2.0)	0.2
9	72.3	(13)	71.7 ± 2.3	(7)	71.6 ± 1.6	(5)	71.8 ± 2.5	(0.02)	1.0

9.3.1c. Comparison of mean weight of breast, bottle and mixed fed females and males to NCHS reference

Figures 9.1-9.6 show the mean weights by age and feeding type among females and males compared to the 50th centiles of reference population (median). Breast fed males and females had mean weights approximately similar to infants of the same age and sex in the reference population. However, bottle fed males were lighter than the infants of reference population at birth, and then they caught up as the age increased (Figure 9.4).

Figure 9.1
Weight-Breast Fed Saudi Females
Comparison With Reference Population

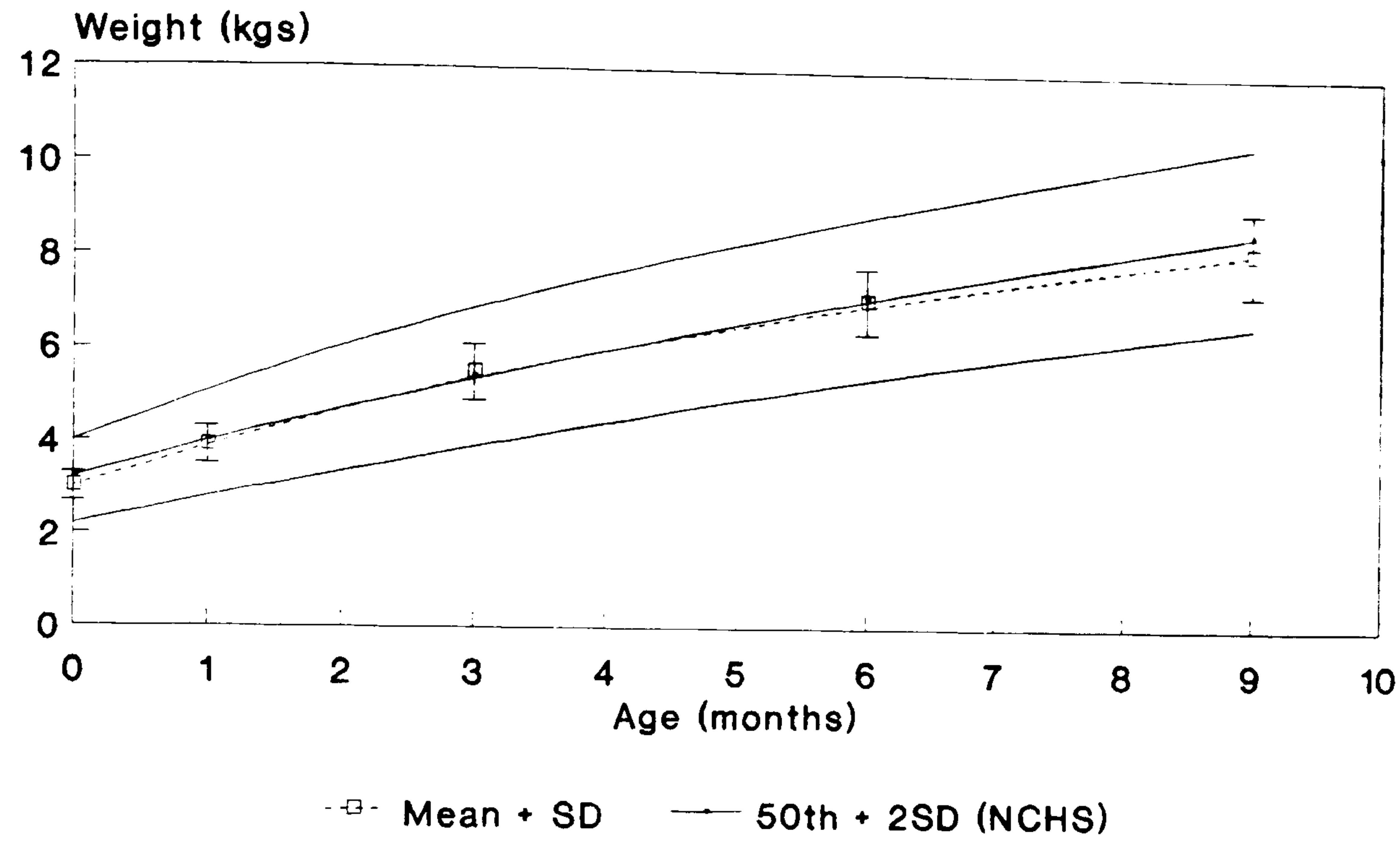


Figure 9.2
Weight-Breast Fed Saudi Males
Comparison With Reference Population

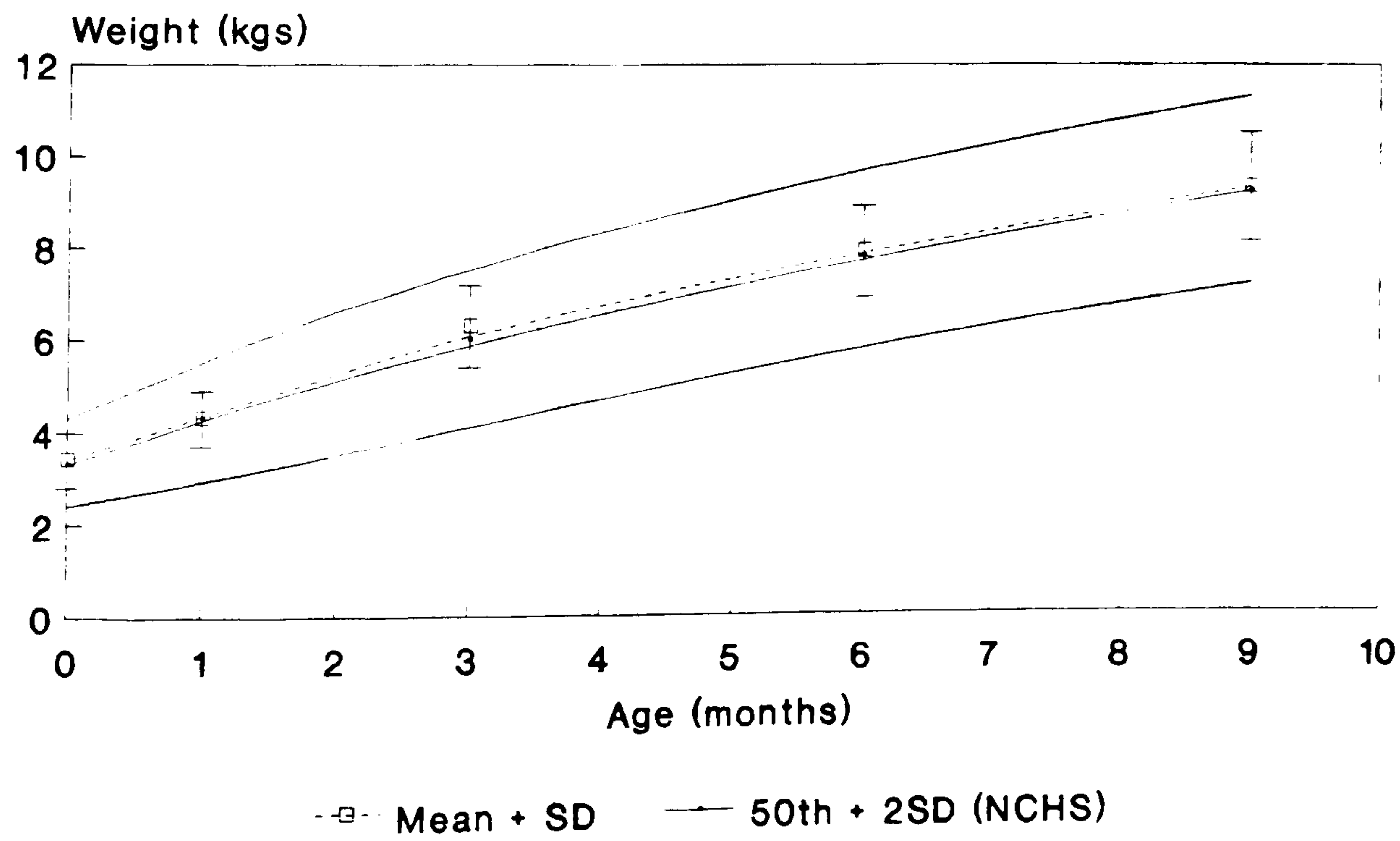


Figure 9.3
Weight-Bottle Fed Saudi Females
Comparison With Reference Population

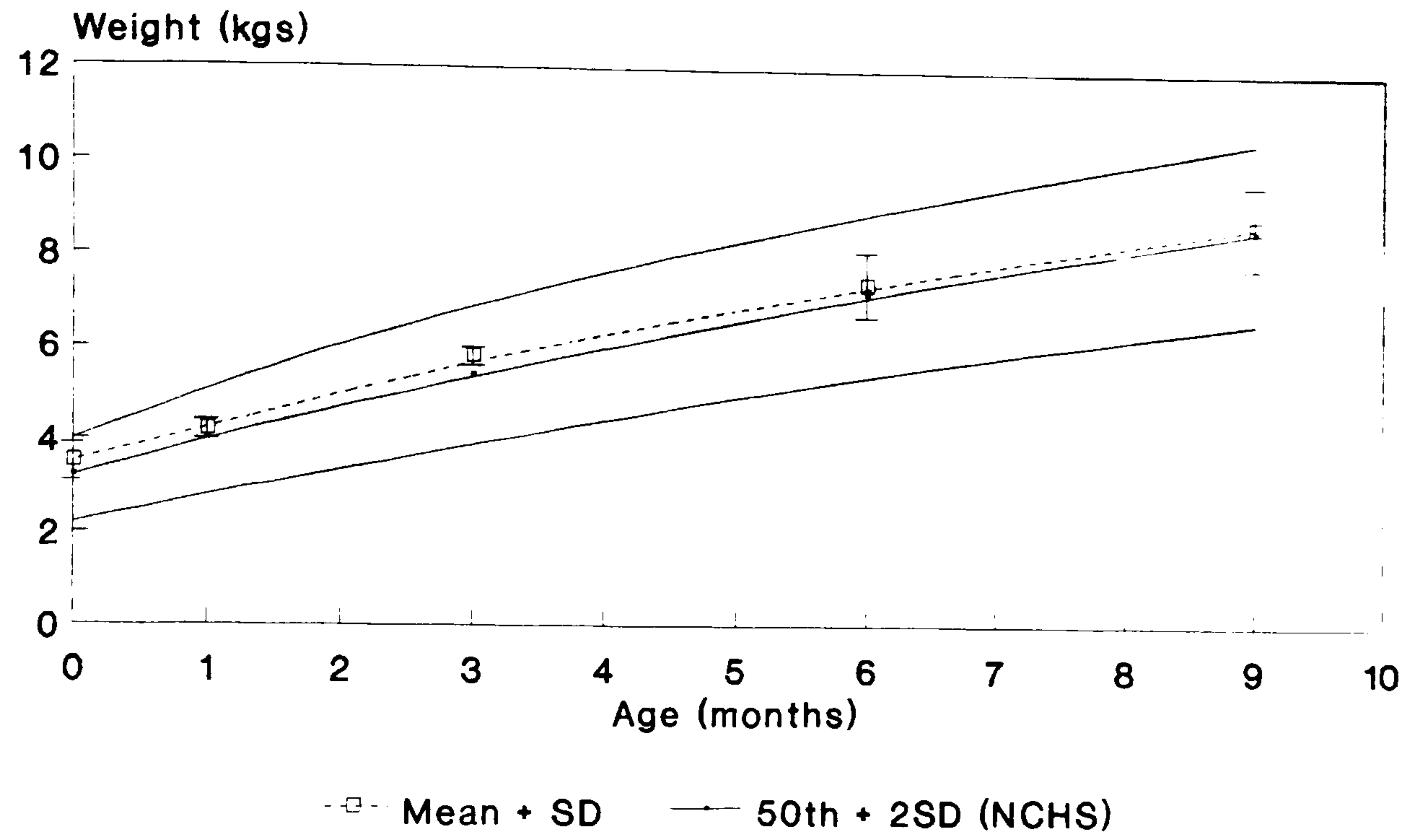


Figure 9.4
Weight-Bottle Fed Saudi Males
Comparison With Reference Population

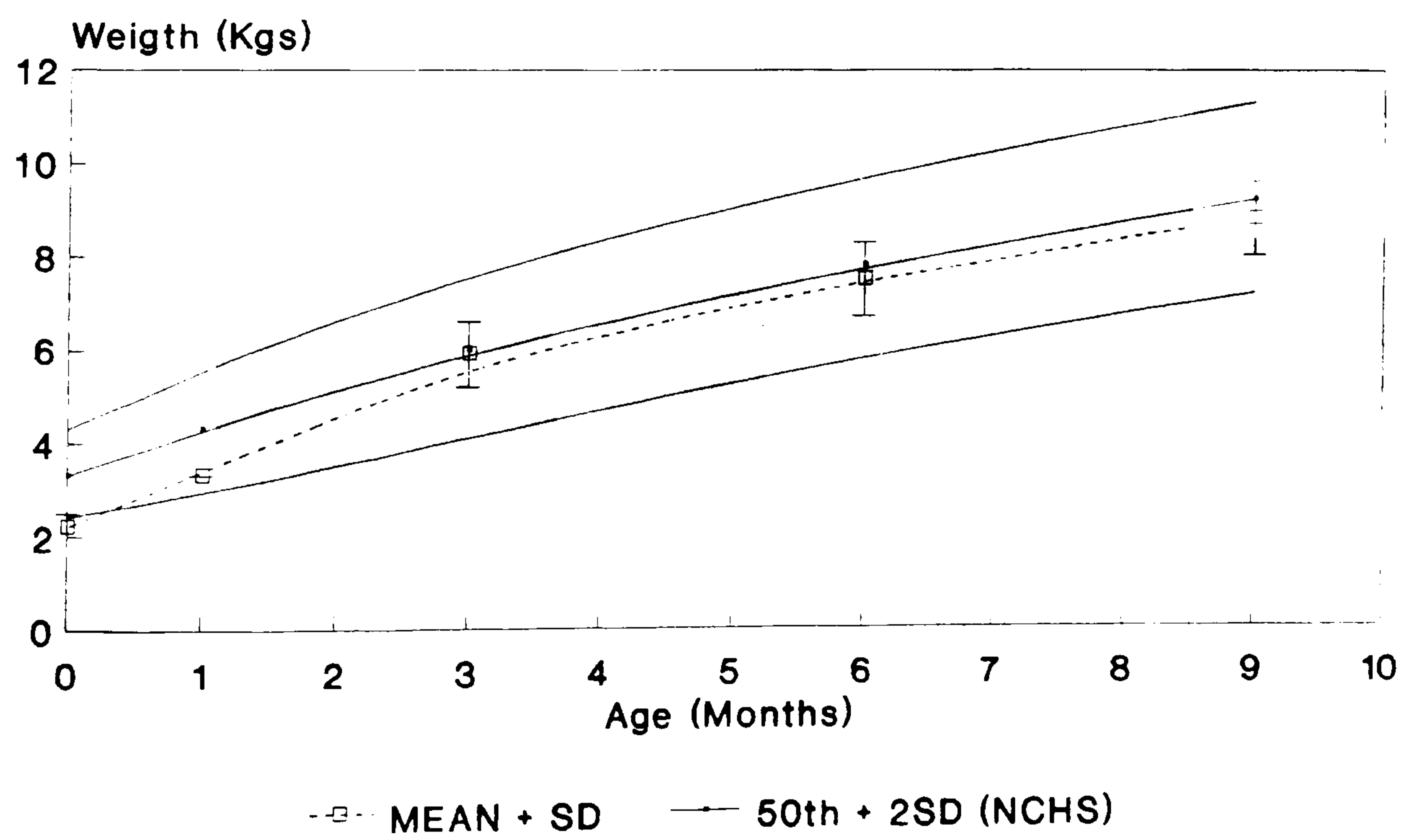


Figure 9.5
Weight-Mixed Fed Saudi Females
Comparison With Reference Population

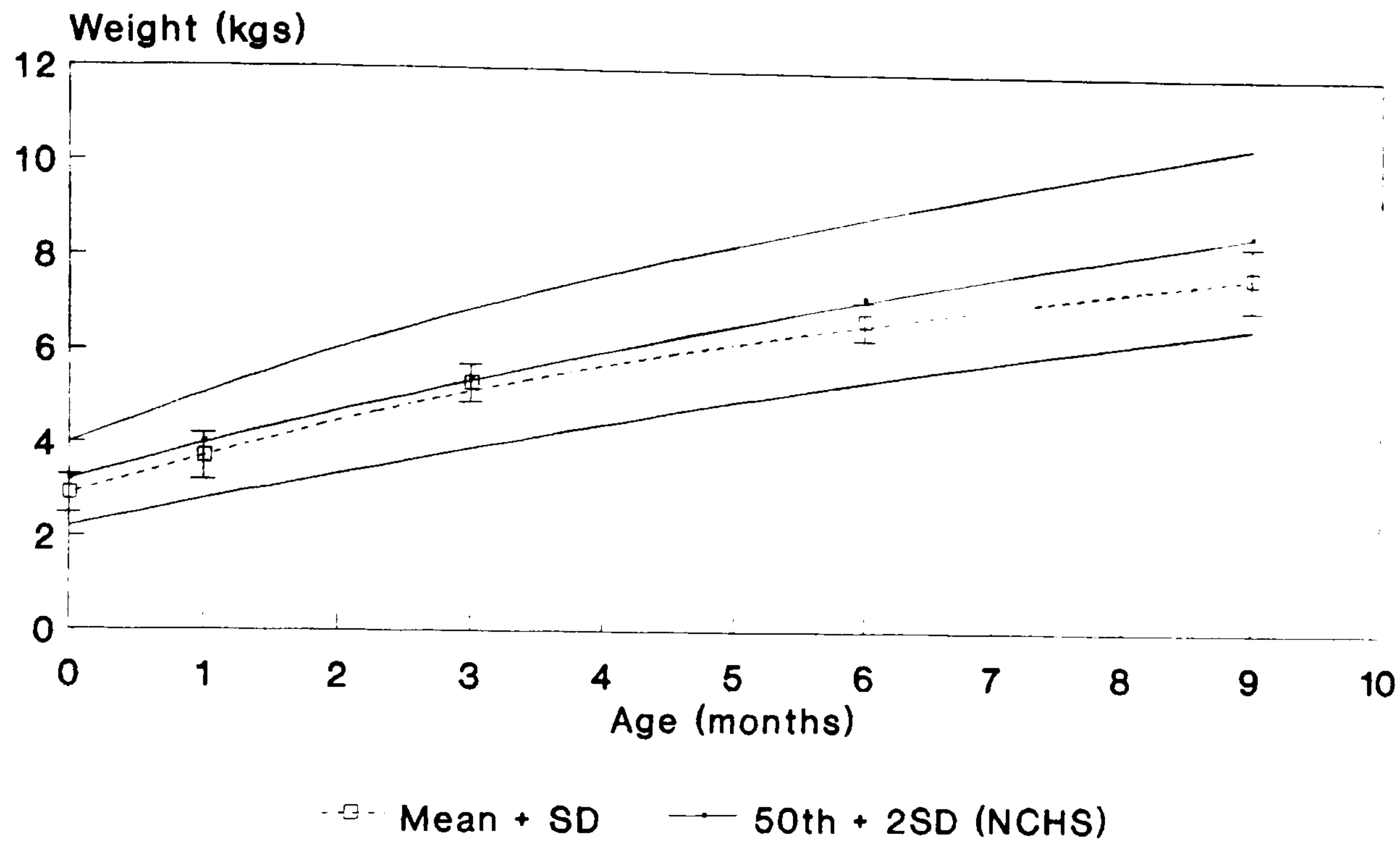


Figure 9.6
Weight-Mixed Fed Saudi Males
Comparison With Reference Population

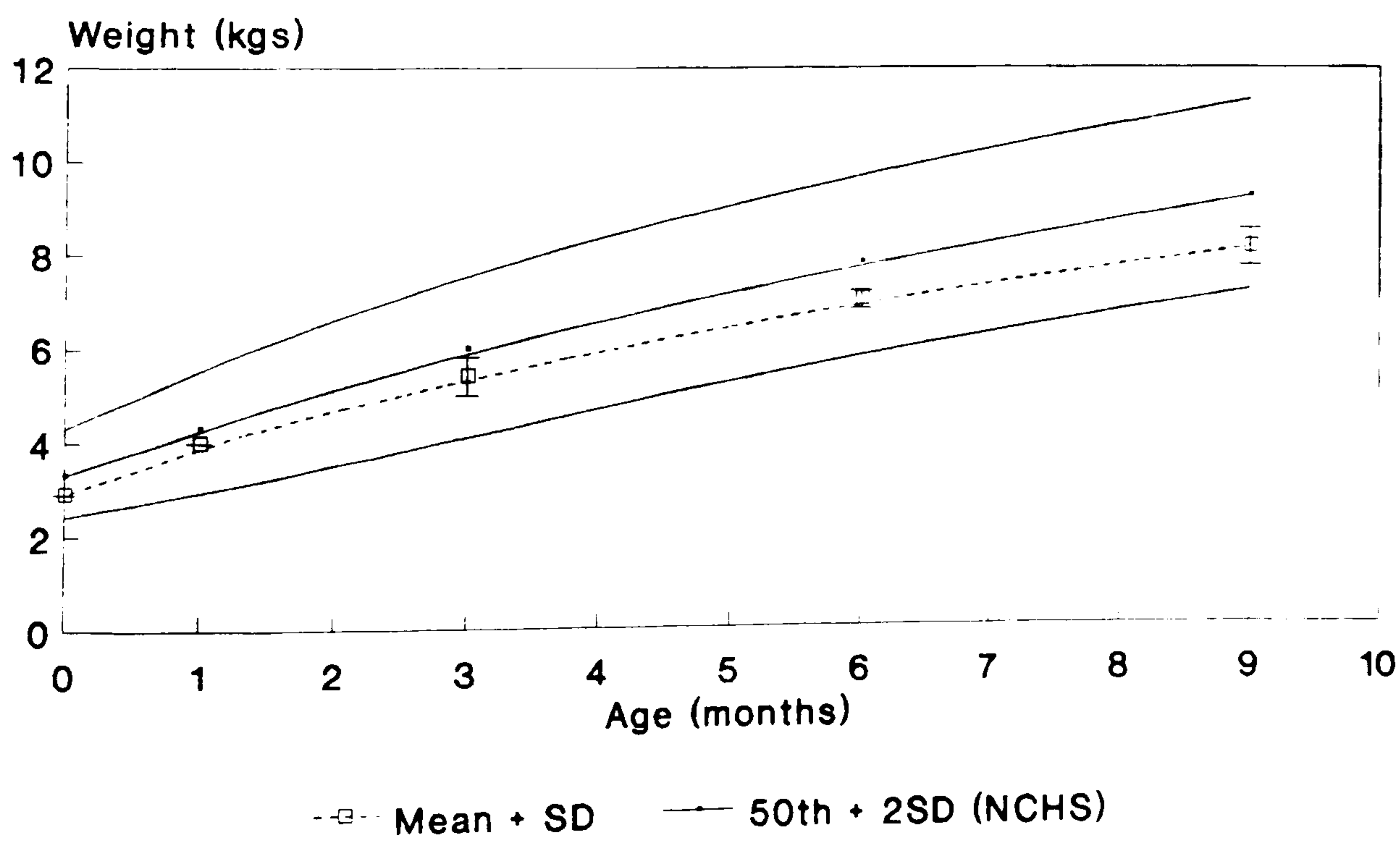


Figure 9.7
Weight-All Saudi Females
Comparison With Reference Population

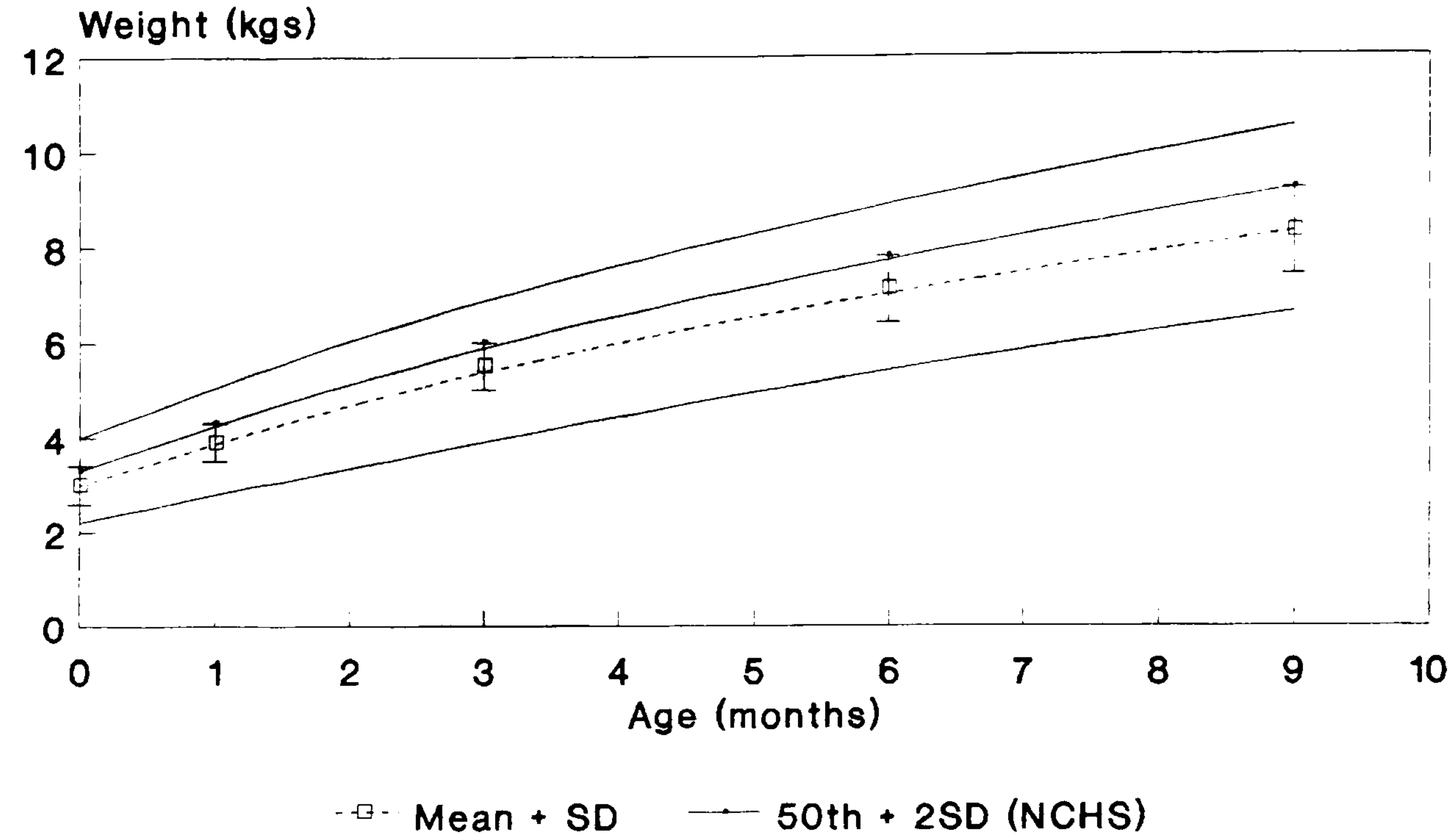
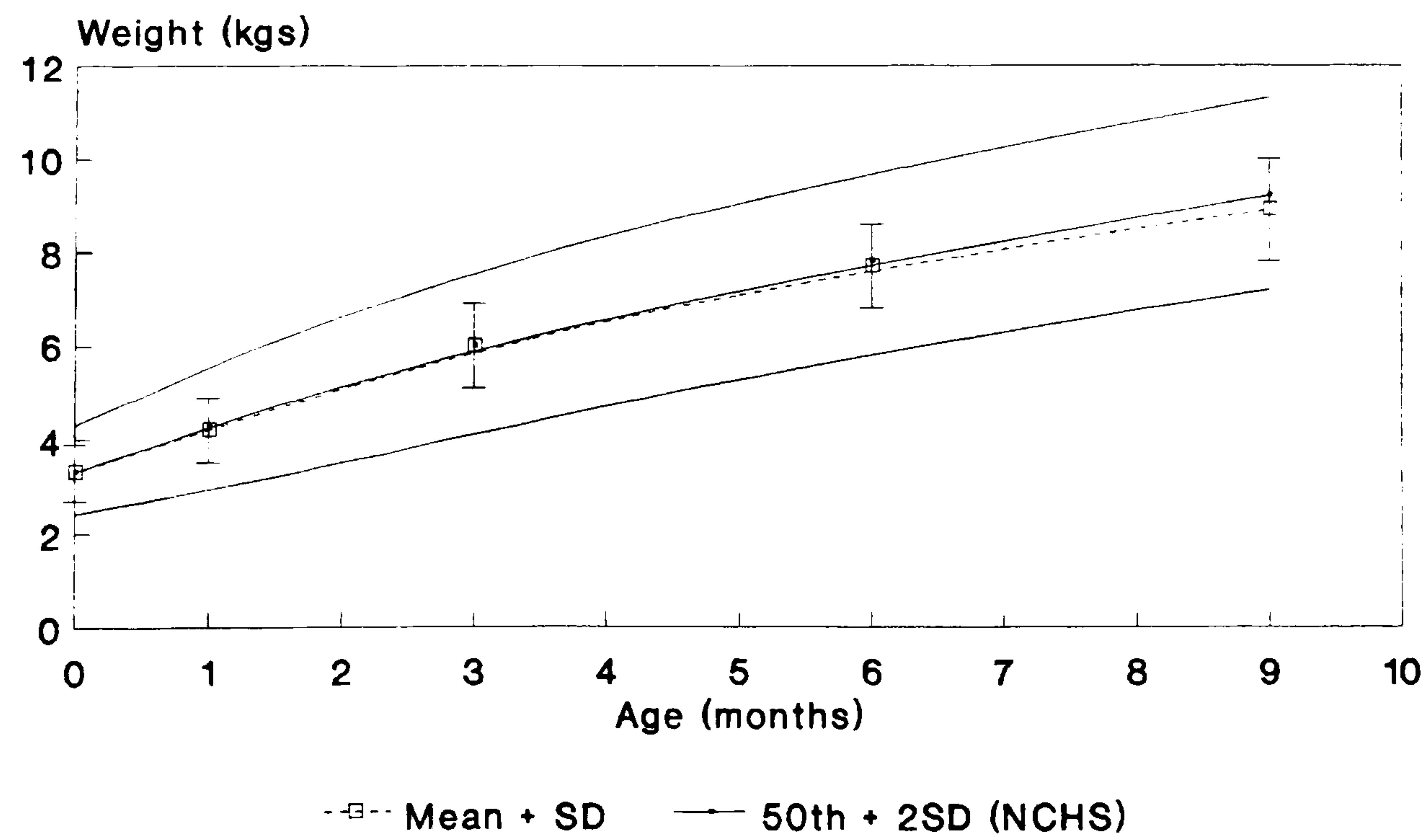


Figure 9.8
Weight-All Saudi Males
Comparison With Reference Population



As for mixed fed males and females, the mean weights were a little lower than the reference population at birth, one month and 3 months of age, then the gap between the two groups increases at ages of 6 and 9 months. Therefore, males and females were lighter at these two periods of age, particularly at the age of 9 months than the reference population. This relationship was also observed when comparing the mean weights of females and males (without specifying feeding type) by age only to the reference population (Figure 9.8).

9.3.1d. Comparison of mean length of breast, bottle and mixed fed females and males to NCHS reference

Figures 9.9-9.14 show the mean lengths by age and feeding types among females and males compared to the 50th centiles of reference population (median). Mean lengths of breast and mixed fed infants and bottle fed females were identical to median lengths by reference population (NCHS). However, bottle fed males (Figure 9.12) tended to be a little shorter a birth, one month and 3 months of age as compared to the reference population. But these males caught up with the standard at the ages of 6 and 9 months.

When mean length of females and males (without specifying feeding type) by age only were compared to standard, no significant difference was found (Figures 9.15 & 9.16).

Figure 9.9
Length-Breast Fed Saudi Females
Comparison With Reference Population

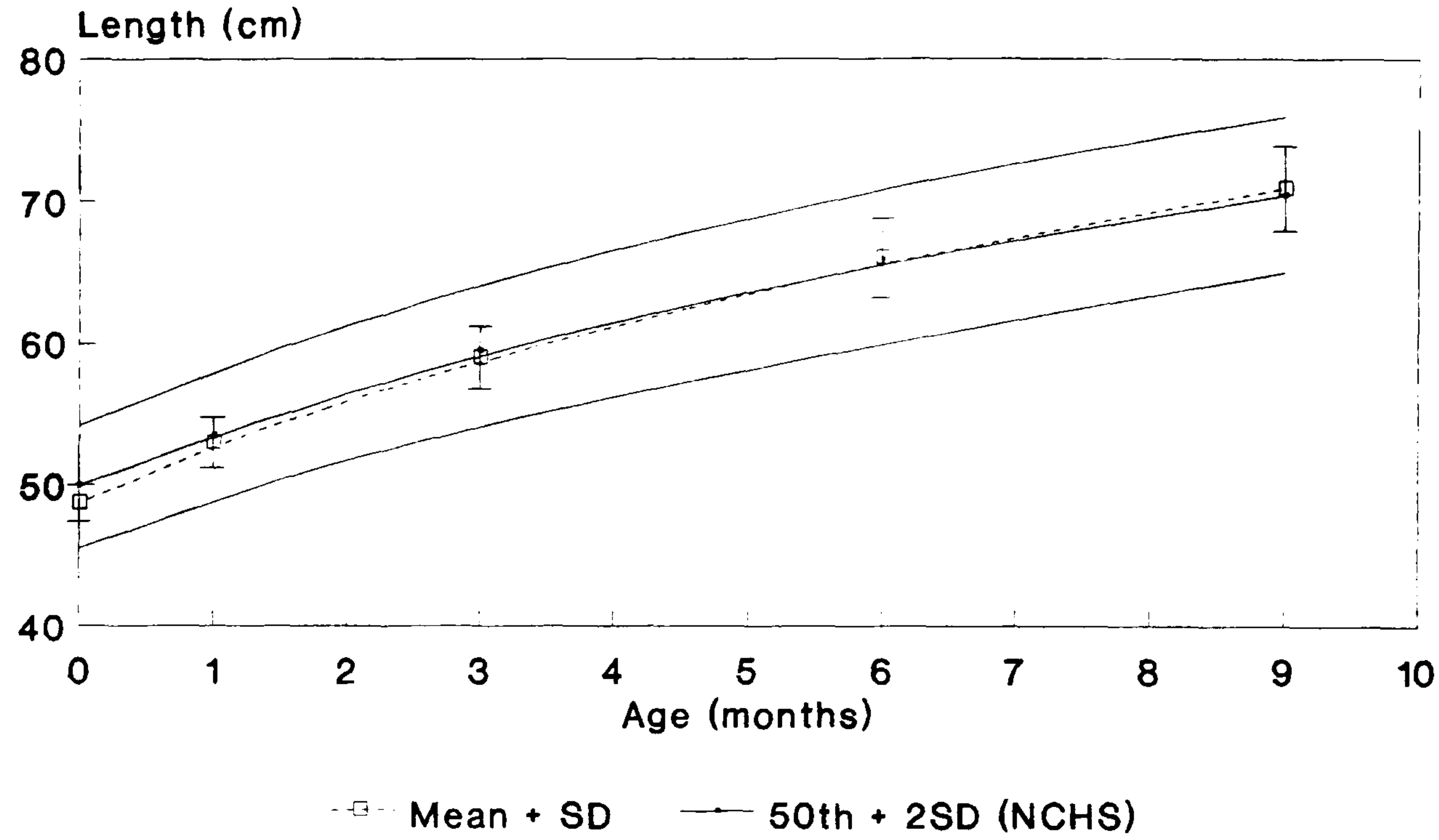


Figure 9.10
Length-Breast Fed Saudi Males
Comparison With Reference Population

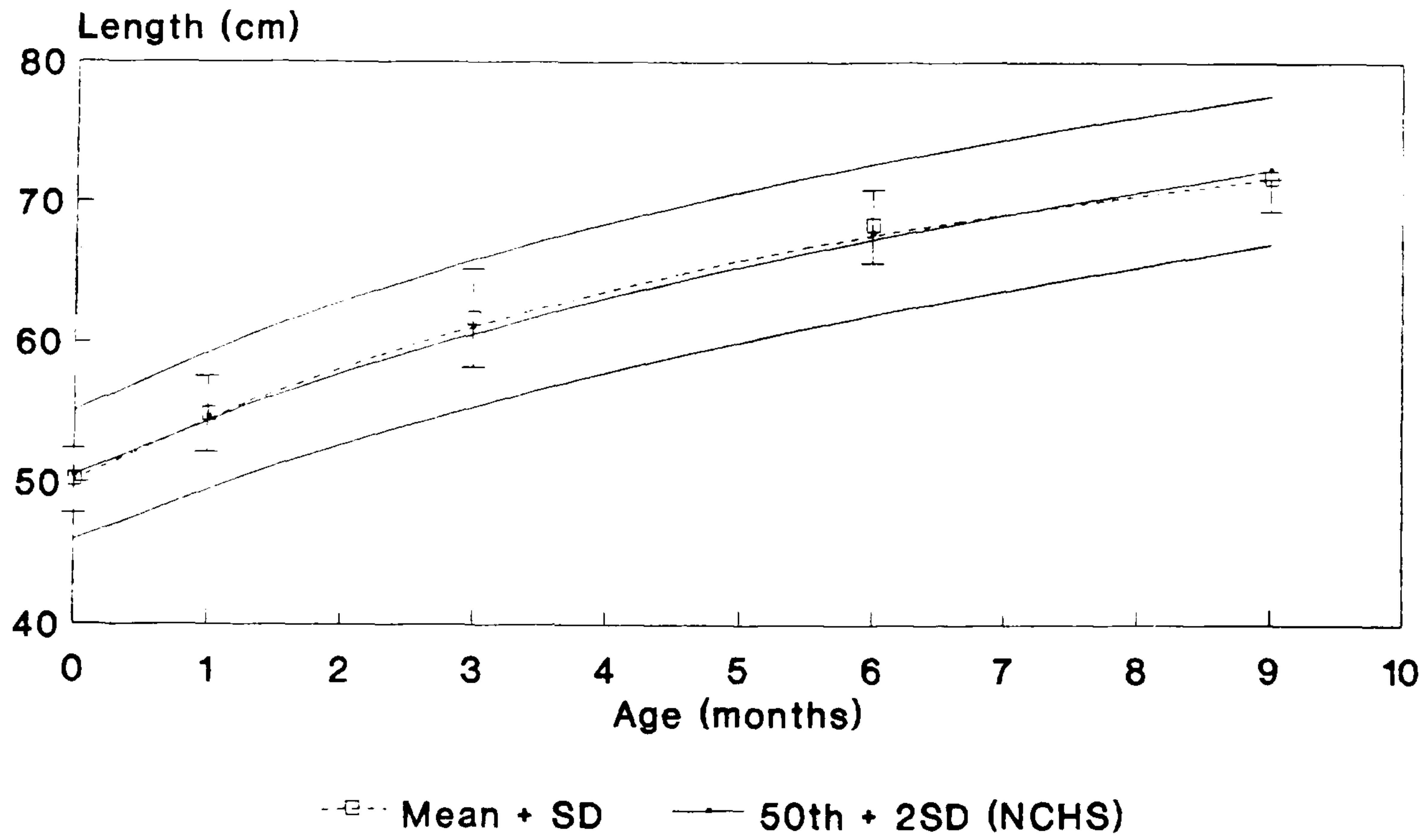


Figure 9.11
Length-Bottle Fed Saudi Females
Comparison With Reference Population

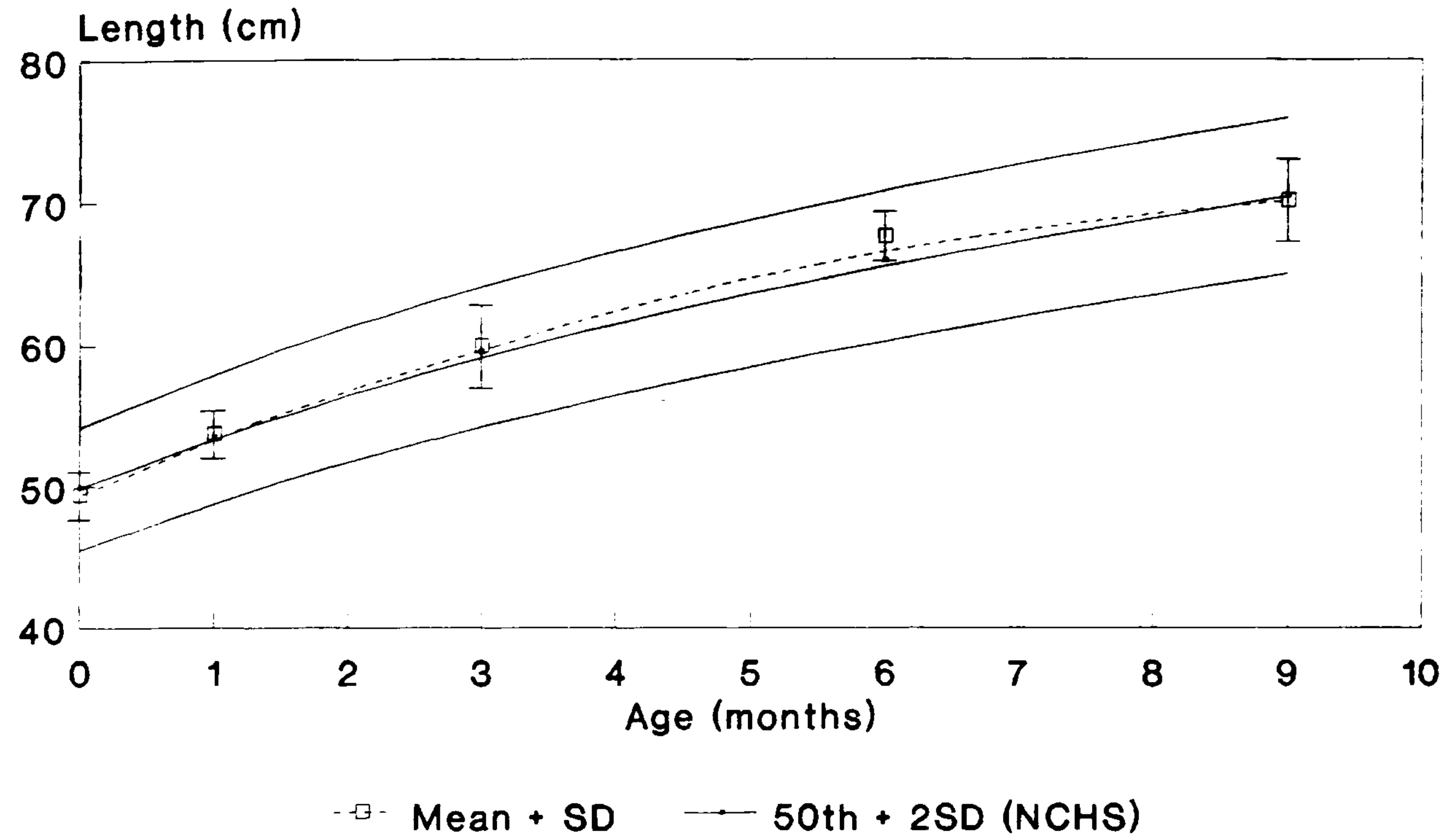


Figure 9.12
Length-Bottle Fed Saudi Males
Comparison With Reference Population

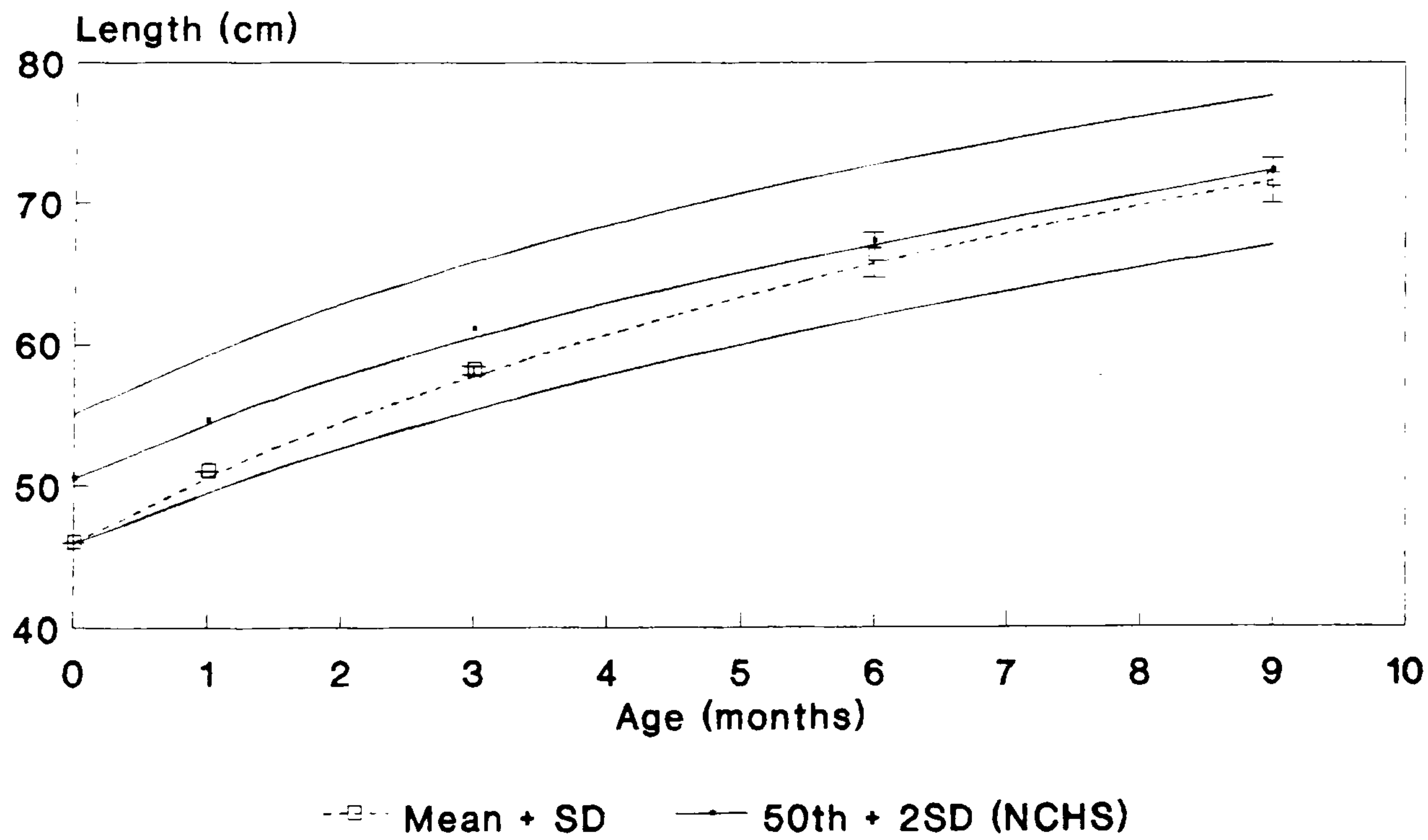


Figure 9.13
Length-Mixed Fed Saudi Females
Comparison With Reference Population

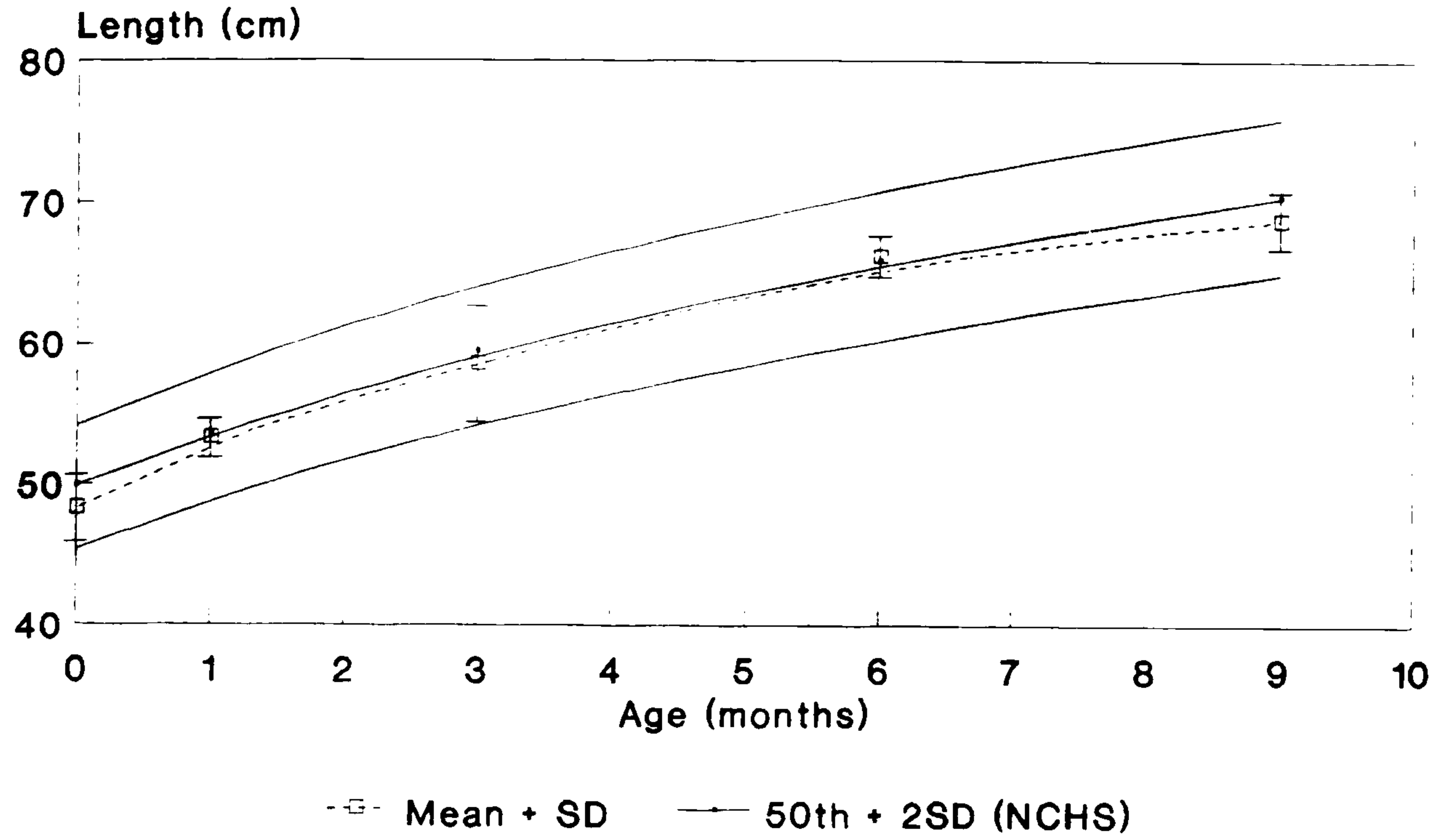


Figure 9.14
Length-Mixed Fed Saudi Males
Comparison With Reference Population

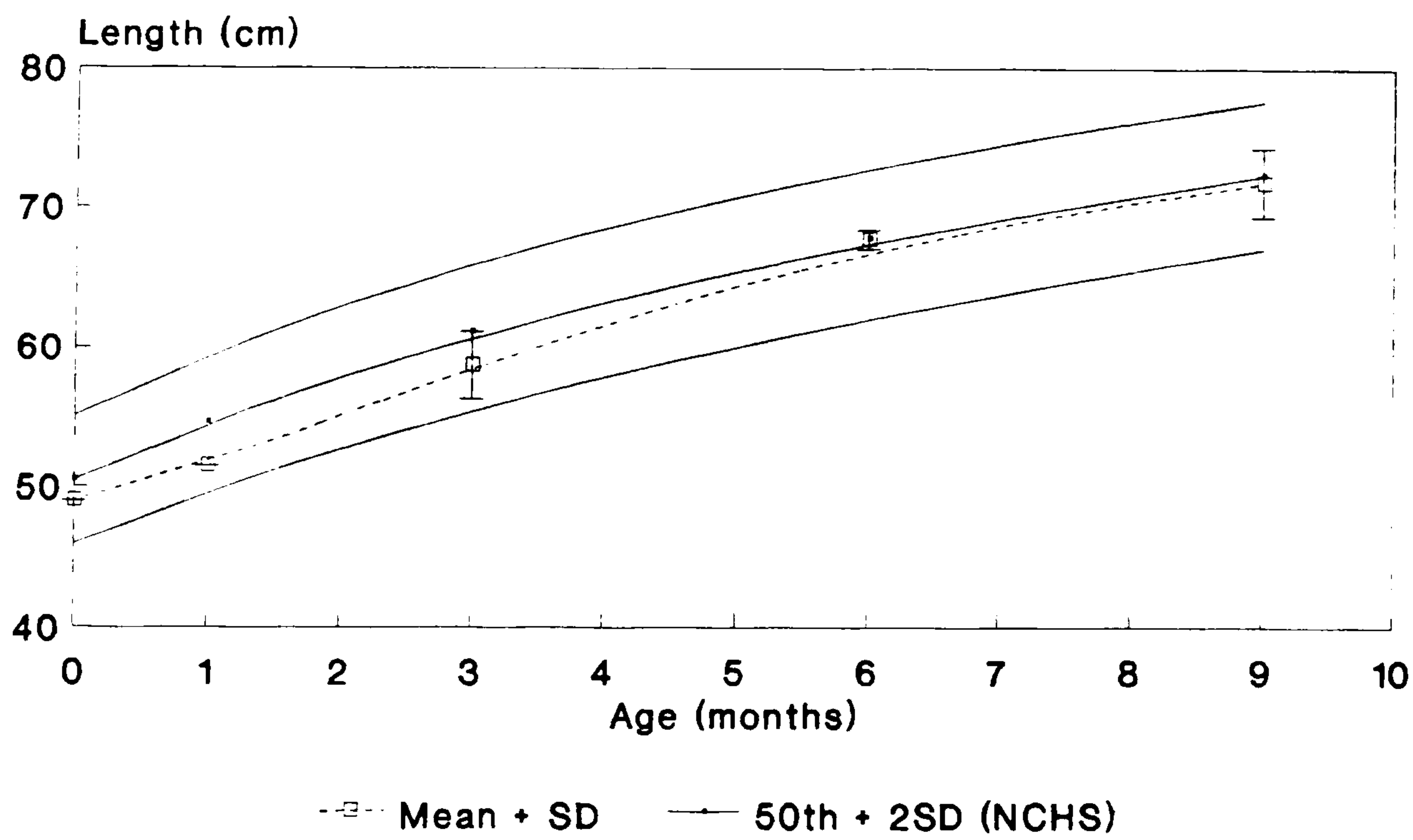


Figure 9.15
Length-All Saudi Females
Comparison With Reference Population

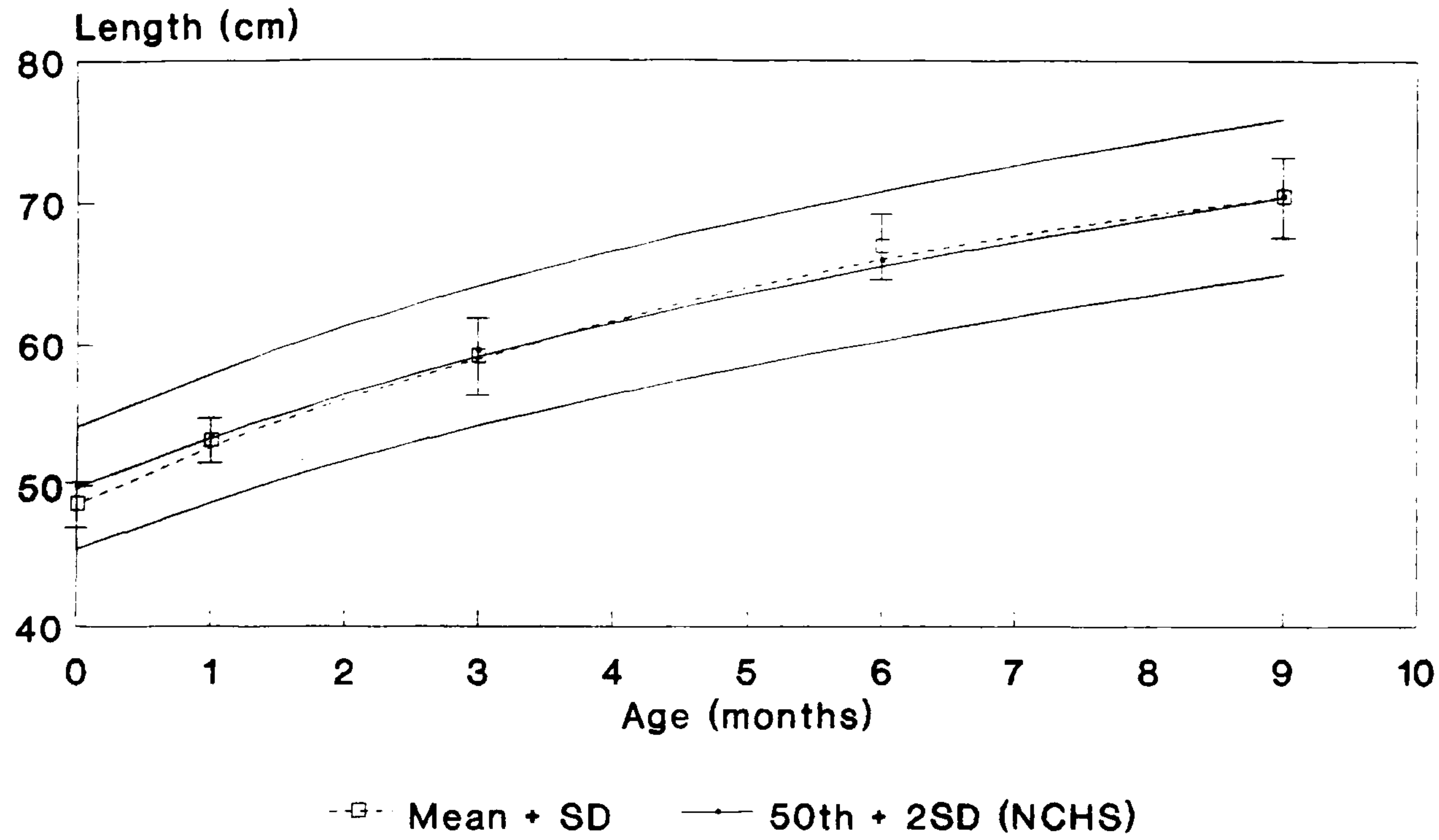
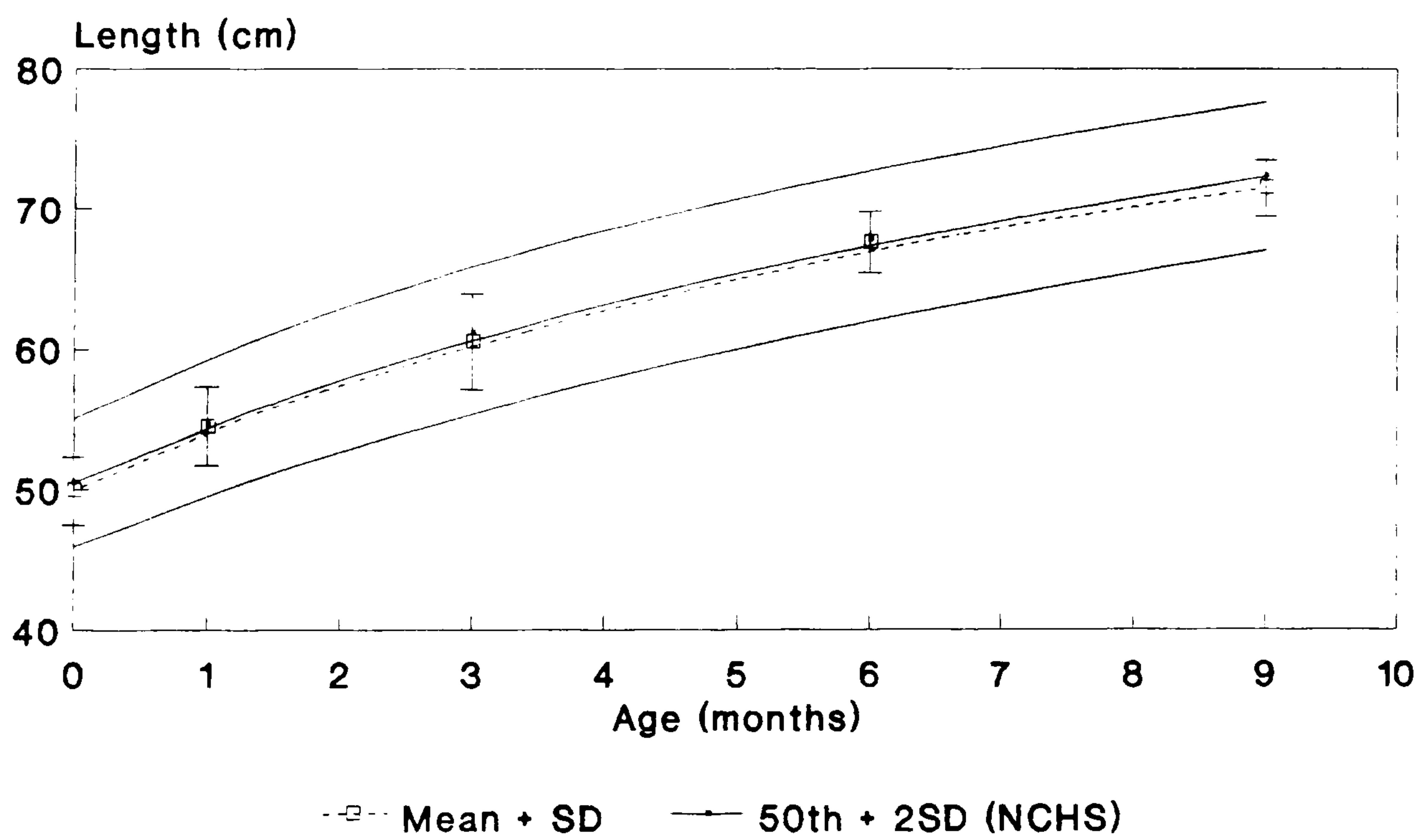


Figure 9.16
Length-All Saudi Males
Comparison With Reference Population



9.3.2. Age of Introduction of Solids

Looking at the various degrees of malnutrition, it was noted that more obese infants were found at each age than wasted and stunted, particularly at the age of 3 months (31%). Most of these infants were breast fed and only a small number was bottle or mixed fed. This could be explained by the introduction of solid foods at an early age of 2-3 months and being given sugary water since 1 month of age. In addition, obesity might be due to genetic factors, since more mothers were obese at that age interval.

Cases of severe wasting were only observed at the age of 1 month, while no cases of severe stunting were found at any age. However, mild and moderate wasting were more common between the 6th and 9th months of age, while mild and moderate stunting were more common at the age of 3 months. Most of these infants who suffered these degrees of wasting and stunting were breast fed. This might indicate that breast feeding was inadequate for these infants and in addition some of them had suffered from diarrhoea during that period.

9.3.3. Diarrhoea

Diarrhoeal disease can contribute to growth problems for infants. The effect of diarrhoea on growth at first visit is shown in Figures 9.17 to 9.19. Infants with weight/age under the 25th percentiles were more likely to have suffered from diarrhoea than not to have, but there was no pattern in the following visits. Considering length/age again infants below the 50th centile were more likely to have diarrhoea than not to suffer from it. This was not sustained afterwards. While there was no difference in representation of children with or without diarrhoea below the 25th centile of weight/length at the first visit. This is a somewhat curious finding since one would expect this parameter to be most markedly affected by an acute illness like diarrhoea.

Figure 9.17
Weight/Age Centiles At 1st Visit
For Saudi Infants With/Without Diarrhoea

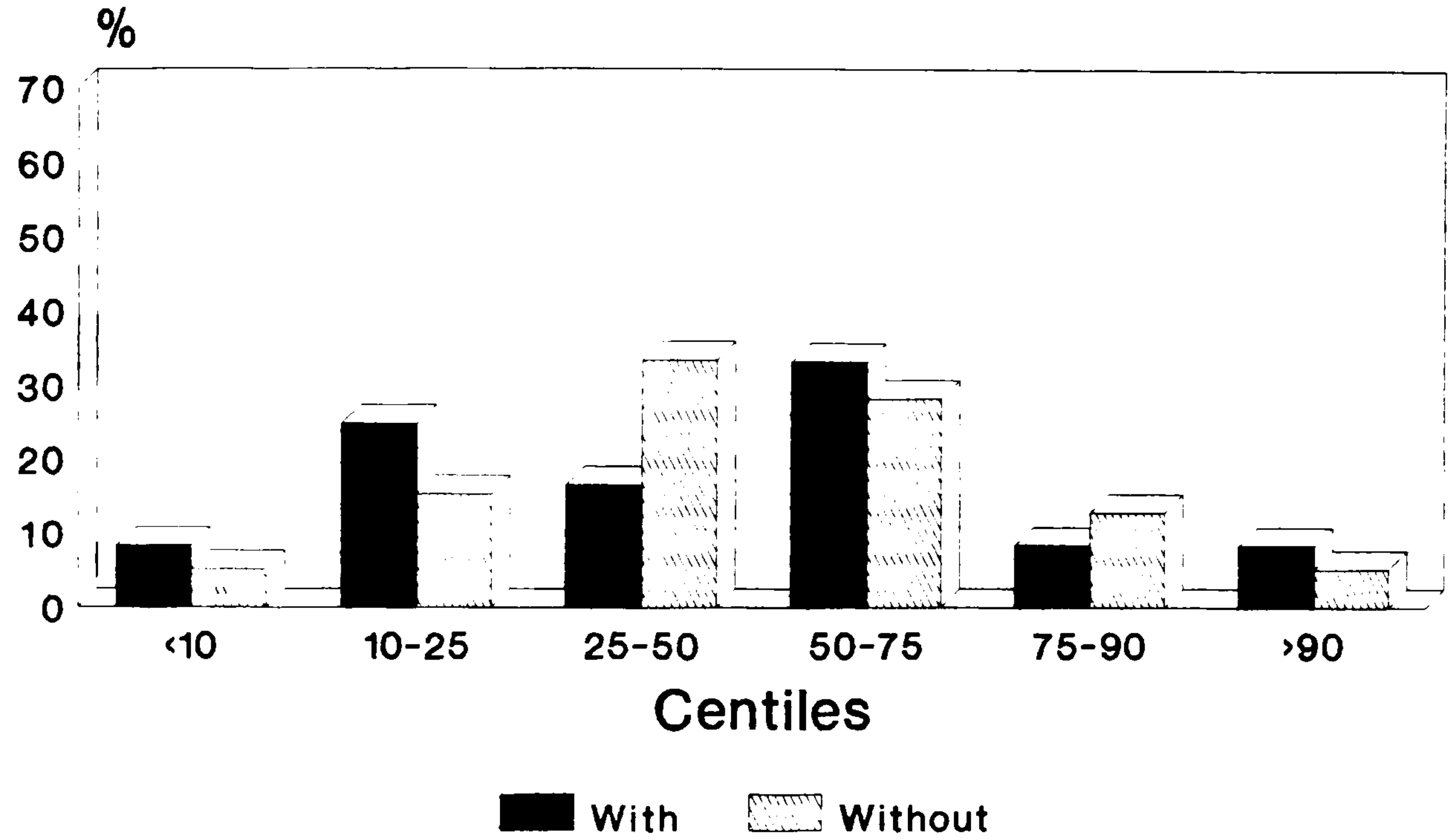


Figure 9.18
Length/Age Centiles At 1st Visit
For Saudi Infants With/Without Diarrhoea

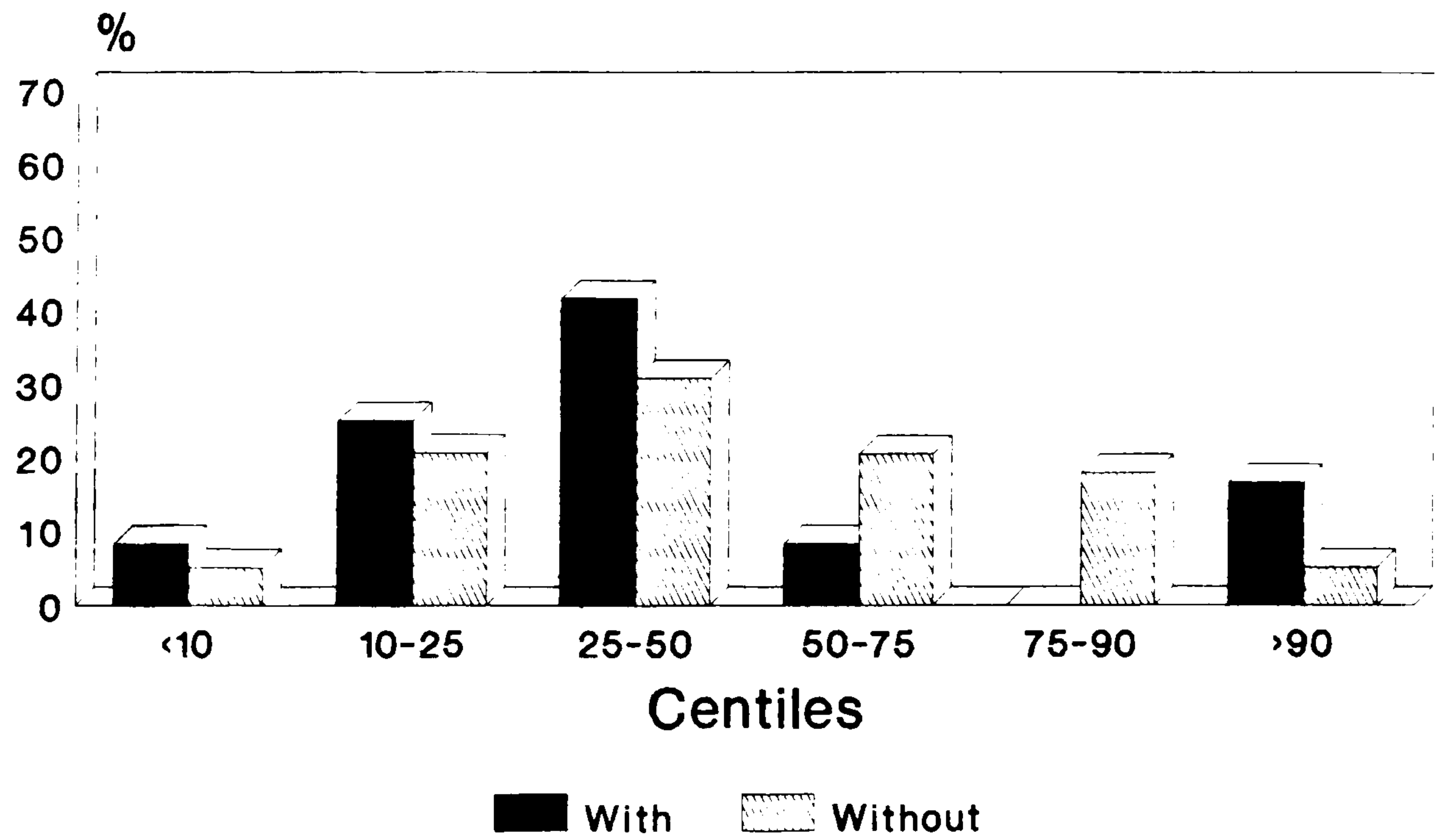
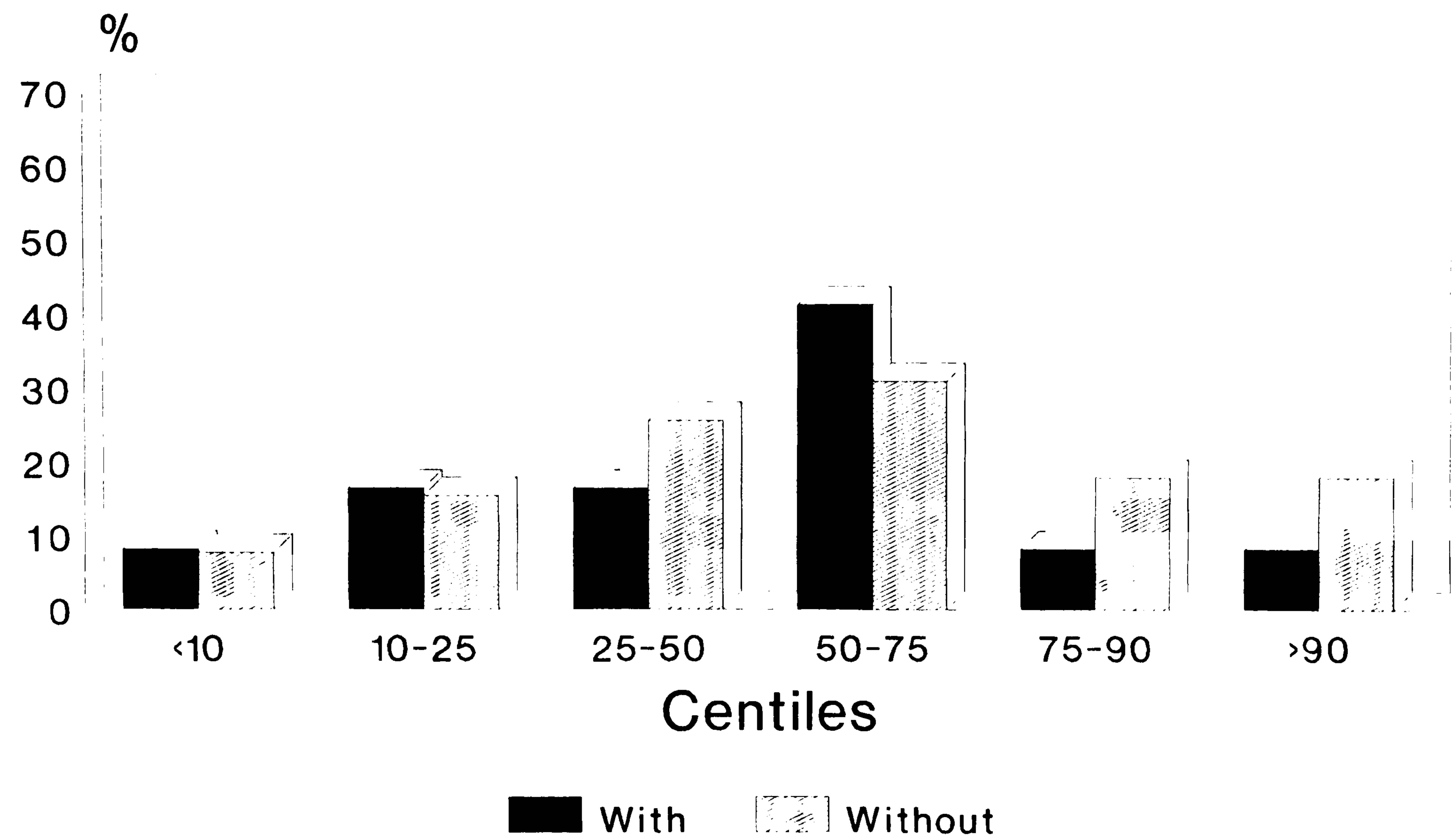


Figure 9.19
Weight/Length Centiles At 1st Visit For Saudi Infants With/Without Diarrhoea



This may reflect mothers' definition of what was considered diarrhoea and the severity of the attack. Conversely those children with diarrhoea were less commonly found among those who were overweight for their length. Findings from other studies (Martorell *et al.*, 1975) showed that days ill with diarrhoeal disease alone accounted for approximately 10% of the total growth retardation in length and weight during the first year of life.

Mothers of infants with diarrhoea had a tendency to be illiterate, older (21-46 years) and with fewer children (1-5). In addition, they come from a less privileged group. This pattern was observed in all visits. Ignorance of bottle feeding, hygiene and supplementary foods may lead to serious health problems which in turn influence infant's growth.

9.3.4. Maternal Characteristics

Maternal characteristics (age, number of living children, socio-economic status and BMI) might influence infant's growth. In this study, mothers with infants who were growing outside the normal range of length/age and weight/length had a tendency to be older and have more children aged 1-5. As for education and type of accommodation, infants with length/age above the normal range had educated mothers and lived in owned homes; whereas there was no clear difference among the mothers who had infants with under length/age regarding education.

While infants showing a degree of wasting were more likely to have mothers with low education; however, infants above normal range of weight/length had educated mothers who also had a tendency to be obese.

9.5. Summary

Fifty-one infants from Dammam in Eastern Region of Saudi Arabia were examined anthropometrically for 9 months at different periods. There was no significant difference in mean weight, length, mid arm circumference and head circumference among all infants, or in mean lengths between males and females regarding feeding types; however, males who were breast fed have a tendency to be heavier at the age of three months than those who were bottle or mixed fed. In addition, breast fed infants had also mean weights approximately similar to infants of the same age and sex in the reference population, but bottle and mixed fed infants were lighter as compared to the 50th centile of the reference population.

Stunting and wasting did not seem a major nutrition problem of infants living in the urban area. Only four percent of infants at the first month were severely wasted, whereas no severe stunting cases were found. The data suggests that infantile obesity could already represent a problem for many infants at each age, particularly at 3 months. Most of these infants were breast fed. The reasons behind obesity might be due to the introduction of sugary solutions since the first months and in addition to the early introduction of solid foods at the age of 2-3 months. Other indications could be due to genetic factors, since some obese infants had obese mothers (with high BMI).

Factors such as diarrhoea and maternal characteristics could play a role in affecting infant's growth. Diarrhoea, especially long episodes, result in the infant growing poorly affecting length and weight. In this study, infants with weight/age under the 25th percentile suffered more diarrhoea than other groups; however, this situation was found at both lower ends of weight/length percentiles.

When studying the relationship between maternal characteristics and growth, there was no statistical significance between them due to the small number of the sample. However, it was noted that mothers of infants who grew outside the normal range of length/age and weight/length tended to be older and have more children aged 1-5.

It has been suggested that infants from more educated families were growing better than those from other families. This was so in the case of mother's education and weight/length. Infants with lower weight/length were more likely to have illiterate mothers, while infants with weight/length above normal range had more educated mothers with a tendency to be obese themselves.

CHAPTER X

CONCLUSIONS AND RECOMMENDATIONS

10.1. Introduction

As indicated earlier, maternal and child health are accepted as the corner-stones of good health in the community. But on the basis of statistics such as rates of low birth weight, perinatal and infant mortality it seems that the health status of these groups in Saudi Arabia may be less than optimal. Despite the fact that a large proportion of the population are fairly affluent in comparison with many newly industrialising countries.

Martorell (1985) has attempted to elaborate the complex interaction of factors which combine to influence the health status of infants through the intermediate outcomes of nutrient intake and infection. In doing so, he has highlighted the role of demographic, economic and cultural factors which influence caretaker competence, food and other resources including health care resources, maternal nutritional status, environmental sanitation and food preparation facilities.

In view of the relatively high standard of living in Saudi Arabia, it is perhaps not surprising that Serenius (1988) has identified infection and poor education of the mother leading to malnutrition as the key factors which account for poorer growth amongst certain groups, rather than a shortage of food.

Serenius *et al.* (1988) have characterised the obstetric population in a Riyadh hospital as having a high standard of living, adequate energy reserves at confinement and an absence of hard physical work during pregnancy. As a result, he attributes poor perinatal statistics to predominantly cultural factors; pregnancies at extremes of the reproductive age range, short birth intervals, low educational attainment of mothers and poor use of acute services.

In this small study of birth records which was undertaken in Damman, a further culturally-related influence, the Ramadan fast, also appeared to be associated with low birth weight. This finding seems to suggest that even in this relatively privileged group, maternal eating patterns can still affect birth outcome.

The second study of pregnant women lent further support to the suggestion that fasting during Ramadan led to significant differences in nutrient intakes. The influence of another key, culturally-determined, factor - caretaker competence, was also evidenced, just as Musaiger in Bahrain (1977) demonstrated that more educated mothers had better food habits, in the second study of pregnant women in Saudi Arabia, more educated mothers had higher intakes of energy and certain nutrients. An association has also been reported between the educational level of the mother and the risk of childhood malnutrition by Bairagi (1980) and Al-Dabagh and Ebrahim (1984). This may in part be related to environmental sanitation. Karrar and Abdullah (1981) in a prospective study of gastroenteritis in Riyadh found that only 20% of mothers of children with gastroenteritis sterilised teats and bottles properly. In the third of these studies undertaken in Dammam, a third of bottle-feeding mothers were illiterate. Only half of the bottle-feeding mothers sterilised the bottles and over one-third did not boil the water to make up the feed.

It seems clear that in the absence of severe economic constraints in this population there is indeed evidence of the effects particularly of cultural factors on the health and nutritional status of these infants. Mediated through resources such as maternal nutritional status, environmental sanitation, the influence of Ramadan and her competence as a caretaker related to educational level.

The characteristics of these mothers as identified in the studies reported here, and those of Serenius *et al.* (1988a,b,c) and Swailem *et al.* (1988) and others point to the existence of an "urban-relatively well-to-do uneducated" group of mothers as first proposed by Pellett (1970) in the cities of Saudi Arabia. Providers of health care and those involved in nutrition activities will need to be aware of their existence, as well as planning for traditional, recently urbanised poor, urban educated and 'naturalist' urban educated groups of mothers in programmes in Saudi Arabia.

The other main findings of this research concerning factors influencing pregnancy outcome, maternal food habits and nutrient intakes and infant feeding practices, will be seen in the next section.

10.2. General Conclusions

Maternal factors such as environmental, biological and medical factors have been suggested to influence the outcome of pregnancy. In this study only two of the maternal characteristics examined were significantly related to low birth weight, age and height. More young and short mothers were found to have low birth weight babies. The effects of other factors such as gravida, parity, mother's condition and haematological levels were not apparent in this study. This may be due to their socio-economic background which might protect them from adverse outcome. However, exposure to fasting during the second stage of pregnancy did seem to increase the risk of having low birth weight babies. In addition, the timing of the first visit and the total number of visits to antenatal clinic had no influence on birth weight; however, the number of antenatal visits was significantly related to the baby's head circumference. Food intakes of mothers during reproductive periods are regulated through culture, food habits and beliefs which are transmitted from generation to generation and aim to protect the health of the mother and her baby. Among the study mothers, traces of traditional hot/cold concepts and food beliefs were found. At the same time, mothers showed some awareness of western ideas concerning food groups which are important during pregnancy.

Pica was not prevalent among mothers and only a small proportion ate green mud and these were mostly the Ramadan group. Pica was inversely related to educational level. Mothers who ate mud were more likely to have low iron and calcium intakes.

There were differences in meal patterns in pregnancy between fasting and non-fasting months, e.g. number of main meals, time of eating, and mean number of food items consumed. Breakfast and dinner in non-fasting mothers took place at a similar time to Sahoor and Fatoor respectively. However, the foods eaten in the Sahoor and Fatoor meals seemed to be more similar to dinner and lunch. Fruit/fruit juices, milk/milk products, tea, coffee, sugar and bread were common snacks in non-fasting months, while mixed dishes and mahalabia were more common in the fasting month.

With regard to the adequacy of energy and nutrient intakes in pregnancy, the mean intakes of most nutrients were lower in Ramadan than other months except for fibre which was lower in Shawal and vitamin C which was higher in Ramadan. These low nutrient intakes might be due to under-reporting the amount of food consumed and also to nausea and vomiting.

The mean intakes of some nutrients fitted with the frequency of consumption of particular foodstuffs - but there were also some inconsistencies. The low mean intakes of energy, protein and vitamin A in Ramadan were not consistent with the higher mean frequencies of lamb, legumes and vegetables consumption in Ramadan than others. However, the low mean intake of calcium and high mean intake of vitamin C in Ramadan fitted with low and high frequencies of consumption of milk/milk products and fruit/fruit juices respectively.

The iron status of most pregnant women in Study II was satisfactory. Twenty-seven percent of mothers were found to be anaemic (Hb <11 g/dl) and mothers with anaemia had low mean intakes of iron and vitamins (C and A). These mothers had a low reported consumption of foods with high iron content.

As for postpartum and lactation, there was some evidence of adherence to traditional beliefs and practices. Traces of hot/cold concept was found among mothers with few special foods consumed or restricted during postpartum and lactation. However, there was no overall consistency between beliefs and practices, as indicated by 24-hour recall data. It is possible that the attachment to traditional ideas was stronger in the early postpartum period and that this pattern had declined by the end of the fourth week when 24-hour dietary recall was taken.

The diet of most mothers during postpartum and later was below recommended levels for protein, niacin, vitamin B_6, vitamin C and calcium, due to consumption of foods with high content of these nutrients, as the meal pattern shows (e.g. milk/milk products, eggs, mixed dishes, meat, liver, fruits and vegetables). However, many mothers must have met their needs for energy because they did not lose weight. Most of them were inactive during the postpartum period and therefore the WHO recommendation for energy might be higher than their needs.

The culture and environment of mothers not only directly affects the nutritional status of the mother through their influence in the food she selects and the diet she consumes, but also indirectly affects the nutritional status of the infants through their effects on the mother. Changes in infant feeding practices were noted in Saudi Arabia, e.g. a decrease in the proportion of breast fed infants, with an increase in bottle feeding with increasing age of infant. This may suggest that the attachment to traditional ideas and religious teaching concerning infant feeding practices becomes gradually less than before. This change in breast feeding patterns has been noted in different socio-economic groups. However, it was more pronounced among urban privileged mothers than other groups (urban less privileged and rural groups) due to increasing affluence (Serenius *et al.*, 1988).

The factors influencing mother's decision for breast feeding or not were various. Natural, nutritious and creating a strong bond between the mother and the baby were the most common reasons for breast feeding. While no breast milk or insufficient breast milk were the reasons for bottle and mixed feeding respectively. Solid foods were introduced to the baby early, at the age of 2-3 months. Differences in infant growth and mother's anthropometric measurements regarding feeding type were not statistically significant.

Anthropometric results indicate that a low proportion of infants was below the 10th centile and most of these were aged between 3-6 months and would be thought to be at possible risk for nutritional problems.

Stunting and wasting did not seem a major nutritional problem or urban infants in this study. This finding was supported by other studies done in the privileged and less privileged infants in the city of Riyadh (Serenius, 1988; Serenius and Swailem, 1988). However, the pattern of growth of infants in the present study was distinctly different from that of infants in rural Saudi Arabia which was characterized by faltering growth during the second half of the first year (Serenius *et al.*, 1988). In addition to the fact that also privileged infants in the same city exhibited a more favourable growth pattern and this indicates that social and educational, rather than genetic, factors are important determinants of growth in Saudi society.

The information achieved in this research should be of value to authorities in health planning, doctors, nutritionists and researchers, in order to improve the health state of mothers and their children. These findings provide a useful basis for more detailed studies of nutrition and food habits among pregnant women and infants in Saudi Arabia.

10.3. Recommendations for Further Research

Findings from this study suggest that cultural and environmental factors played an important role in womens' lifestyle during the reproductive period, especially in meal patterns and dietary intakes. Family food distribution is one of the cultural factors that was not studied in detail. It would be of interest to investigate the patterns of intra-family food distribution and the factors which might affect nutritional status of mothers and their children, because these groups have special nutritional needs.

Another recommended research area includes a controlled study of the effect of fasting in the different stages of pregnancy on the outcome. This would involve an examination of the dietary intake, and biochemical and anthropometric measurements. Useful comparisons could also be made between the different parts of Saudi Arabia. In addition, a study of detailed food beliefs and practices in the initial 1-3 weeks after delivery and how this corresponds to the actual practices of dietary intake during that period would be valuable.

As for infants, it has been found that social and economic factors influence the nutritional status of children. Therefore, it is very important to examine the degree of association between these factors and anthropometric indices, particularly in poor areas of the country.

There is also a need for further work exploring mothers' perceptions of appropriate and inappropriate foods for children at different ages with particular reference to foods appropriate to the management of childhood ailments.

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LIST OF APPENDICES

APPENDIX I

ADDITIONAL BACKGROUND DATA

ON SAUDI ARABIA

1.1. Geography

Saudi Arabia is bounded on the west by the Red Sea, on the south by the two Yemen Republics and Oman, on the east by the Arabian Gulf, Bahrain, the United Arab Emirates and Qatar, and on the north by Kuwait, Iraq and Jordan (see the map).

Along the Red Sea lies a narrow coastal plain. The western mountain in Asir separates the coastal plain from the empty quarter (Rub Al-Khali). To the north-east stretches the Nejd plateau with an average altitude of about 1,500 metres. The elevation drips until it reaches the sea level on the Arabian Gulf. On the western side of the kingdom the mountainous region contains large amounts of minerals (ISPC, 1977).

The climate along the Red Sea is sub-tropical, with hot humid summers and moderate, but warm, winter months with an occasional scanty rainfall between November and February. The central region experiences hot dry summers, with temperatures normally at the 44°C level, and cool dry winters, with occasional cold spells due to the higher elevation. The eastern region is subject to hot humid weather all the year round, with summer temperatures sometimes reaching 43°C and higher (ISADC, 1977).

Saudi Arabia is an arid country. Roughly 80% of the surface area receives an annual rainfall of less than four inches. The climate of the kingdom is so dry that surface water evaporates very quickly. There are no streams or rivers in the country. The water supply comes from such sources as deep aquifers (non-renewable), surface water (renewable), desalination and reclaimed sewage water. The deep aquifers represent about 74% of the total water resources of the kingdom. However, substantial volumes of ground water have been discovered even under the driest Saudi desert.

Almost 200 dams have been built to conserve surface water. The largest are those at Najran and Jizan in the south-west, in order to benefit from the rainfall in those areas. There are also many springs in the kingdom. The eastern province is considered one of the richest regions in the kingdom in this respect and it has at least 160 natural springs near Al-Hasa. Their production capacity varies from a few gallons to 27,000 gallons per minute.

Desalination of sea water is one of the brightest prospects for development. In 1980 more than 20 sea water desalination complexes were producing more than 400 million gallons a day. In 1985 more than 10% of all water resources came from an expanded sea water processing network.

The reclamation from urban waste matter, particularly in the largest cities of the kingdom, constitutes a valuable additional and economical source of water for agriculture and livestock, as well as for industrial use (CCI, 1985).

1.2. <u>Agriculture</u>

The majority of Saudi people living in villages, as well as those living in cities, had not other main resource outside of agriculture before the discovery of petroleum.

Although Saudi Arabia is a desert zone, a full 4.5 million hectares are suitable for cultivation. The area under cultivation in 1975 was estimated to be 592,000 hectares, which was worked by 600,000 workers, a low ratio of 0.987 hectares per worker.

The regions which are suitable for agriculture, rich in water resources and fertile soil, are: Al-Hasa, Al-Qatif, Al-Qaseem, Al-Flaj, Al-Kharj, Jizan, Jiham, Wadi Fatima and Al-Medina.

The ultimate goal of Saudi Arabia is to be self-sufficient in most food products in the long term. As a result of the growth in agricultural production stimulated by Government policies, the importation of foodstuffs decreased from 31.6% of total merchandise in 1970 to 14% to 1980. The agricultural products in Saudi Arabia include temporary winter crops, temporary summer crops and permanent crops.

Temporary Winter Crops: Achievements of the Saudi wheat-growing programme have attracted much attention; wheat production grew from 63,719 tons in 1972-1973 to 6,300,191 tons in 1982-1983. The other cereal crops are barley, millet, sorghum and maize. Sesame seeds are also produced.

Some vegetables and fruits are grown in the winter season such as potatoes, cabbages, squash, eggplant, okra, carrots, dry onions and tomatoes. A comparison of crop production in 1972-1973 and 1982-1983 is shown in Table 1.1A (CDS, 1985).

TABLE 1.1A

Estimated area and production of temporary winter crops in Saudi Arabia

Winter Crops	Production (1,000 tons)		Area (Donum)	
	1972/73	1982/83	1972/73	1982/83
Wheat	63,719	6,300,191	311,646	2,026,521
Millet	7,915	5,341	146,875	77,022
Sorghum	18,930	28,347	1,051,504	480,158
Maize	830	344	12,367	6815
Barley	11,077	1,851	58,047	9,325
Sesame	85	1,486	6,560	23,211
Tomatoes	65,982	96,957	37,054	79,166
Potatoes	422	8,769	521	5,834
Squash	13,707	8,332	8.983	7,596
Eggplant	10,424	12,671	8,061	14,523
Okra	9,352	11,979	6,750	19.511
Carrots	1,236	5,056	933	3,519
Dry onion	42,940	7,464	24,197	6,038

Temporary Summer Crops: Sorghum is one of the most important summer crops. Its production increased from 8,394 tons in 1972-1973 to 18,741 tons in 1982-1983. Other summer cereal crops are millet, maize and rice. Vegetables and fruit are also grown in the summer season such as tomatoes, melons, water melons, eggplant and alfalfa. The change in production of these crops over the decade 72/73 - 82/83 is shown in Table 1.2A (CDS, 1985).

TABLE 1.2A

Estimated area and production of temporary summer crops in Saudi Arabia

Summer Crops	Production (1,000 tons)		Area (Donum)	
	1972/73	1982/83	1972/73	1982/83
Millet	1,969	2,137	27,512	26,524
Sorghum	8,394	18,741	396,503	112,231
Maize	88	328	887	1,445
Sesame	-	803	-	12,713
Tomatoes	115,660	161,002	30,508	114,803
Melons	888	75,553	376	36,397
Water melons	63,716	446,742	23,250	211,320
Eggplant	11,108	21,585	9,924	10,302
Squash	-	31,368	-	23,750
Alfalfa	867,776	-	158,640	308,218

Permanent Crops: Traditionally, and today, dates are the main agricultural product in Saudi Arabia. Their production reached 406,722 tons in 1982-1983. The average annual date consumption for Saudi individuals is shown in Table 1.3A (CCI, 1987).

TABLE 1.3A

The average annual date consumption for Saudi individuals

Group Characteristics	Annual Average Date Consumption (kg/head)
Older people (male & female, over 40 years)	32.5 - 41.5
Youth and children (male, 6-35 years)	5.5 - 9.0
Youth and children (female, 6-35 years)	9.0 - 14.5

Other fruit and vegetable products include lemons, grapes, peaches, apricots, apples and pomegranates. The increase in production of some of these crops is shown in Table 1.4A (CDS, 1985).

TABLE 1.4A

The estimated area and production of permanent crops in Saudi Arabia

Permanent Crops	Production (1,000 tons)		Area (Donum)	
	1972/73	1982/83	1972/73	1982/83
Dates	363,911	406,722	345,660	554,811
Lemons	13,904	8,674	13,548	14,620
Grapes	34,973	42,316	8,273	38,311

As for dairy products, a wide array of subsidies encourages more investors to establish dairies near the cities. Subsidies help pay most of the costs of building dairy facilities and 50% of the feed. In 1986 the Saudi milk output was estimated at 420,000 tons, up from 20,000 tons in 1979. Much of the local milk is blended with imported powdered or evaporated milk to prepare reconstituted milk. The distribution of milk has increased rapidly and consumer prices have declined as competition has intensified. The liquid milk covers 85% of local needs. The average consumption of the Saudi individual in 1980 was about 54.5 kg per year.

Egg output for 1986 has been estimated at 210,000 tones, approximately four times the 1982 average. Imports provided only 3% of the egg supply in 1984, and some exports to neighbouring countries have been made in 1986 (Arab News, 1987). The average consumption of eggs of the Saudi individual in 1980 was about 2.4 kg per year (around 120 eggs/year). Subsidies for food and facilities contributed to a striking rise in local chicken meat output, from 7,000 tons in 1970 to an estimated 305,000 tons in 1986 (Arab News, 1987). This covers about 43% of local needs.

The number of chicken farms also increased from 46 in 1970 to 203 in 1982. The average consumption of chicken meat by the Saudi individual was 31.67 kg per year.

In the field of fisheries, the annual catch reached 37,000 tons in 1982, growing from 17,000 tons in 1970. Most of the fish is caught in the Red Sea (Al-Yom, 1986). The average consumption of fish of the Saudi individual in 1980 was 6.8 kg per year. Many different kinds of fish and shrimp are available in local markets on a highly seasonal basis (Al-Shawaiby, 1976).

As for red meats (goat, sheep, cattle and camel), the local production and the export reached in 1980 was about 18,650 tons and 194,232 tons respectively. The average consumption of red meat of the Saudi individual in 1980 was 24.14 kg per year (Arab News, 1987).

Livestock: Saudi Arabia has an abundance of domestic animals. These animals are; camels, cattle, donkeys, horses, sheep, poultry and goats. The number of livestock and poultry increased from 1974 to 1983, as shown in Table 1.5A.

TABLE 1.5A

The estimated number of livestock and poultry in Saudi Arabia from 1974 to 1983

Livestock & Poultry	Year 1974	1983
Poultry	826,302	2,015,702
Goats	1,242,216	2,793,486
Sheep	2,147,850	5,888,317
Cattle	281,753	198,777
Camels	104,922	367,410

Livestock is kept not only for consumption, but also for work. The bedouins use their camels in the desert and the farmers use their donkeys for all work and movement within the oases. Sheep and goats are used to provide meat for local markets. Cattle are kept by farmers for milking or other purposes.

Saudi Arabia has organised poultry farms in some cities. All the farmers also keep some kind of livestock such as chickens, ducks, pigeons, rabbits and turkeys.

1.3. The Economy

Saudi Arabia is the world's leading exporter of crude oil and liquefied gas, and the second largest producer of these products. Until 1940 the economy was based almost entirely on agriculture. However, with the growth of the oil industry, reliance on agriculture has declined and in 1960 it accounted for 11% of the GDP and in 1972 only 3% of the GDP.

In 1974-75 crude petroleum production accounted for approximately 78% of the total GDP and agriculture accounted for about 1.04% of the total GDP. At about this time Saudi Arabia emerged as a country with a rapidly growing economy. In 1972-73 the GDP rose by over 150% compared with the preceding year, mainly because of considerable increases in both oil prices and production.

In 1983 the oil revenues started declining due to a world slump in prices for crude oil. As a result of consecutive declines oil revenues in the year 1987 were lower than those realised in 1981 by 80%. Since 1984 GDP has been cushioned by an improvement in the non-oil sector and is estimated to have risen by 1%. Crude oil production is estimated to have been around 235 million tons in 1984, compared with 260 million tons in 1983. This accounted for some 29.1% of OPEC production (or about 8.8% of world output).

Gas production in 1984 was estimated to have been equivalent to 10.7 million tones of oil, which is about 7% lower than production in 1983 (11.5 million tons).

These declines in production have cut into the government revenue and, as a result, the government has pursued a restrictive budgetary policy which has had a dampening effect on the economy. However, growth in the non-oil sector, especially in light industry, building and the production of intermediate goods, was up by 4.3% in 1984 according to government sources.

The Saudi economy can be considered to be passing through a transitional phase, from a growth promoted by the construction of a large civil infrastructure to one propelled directly by the development of industrial production and agriculture.

Industry: One of the long-term goals of development for Saudi Arabia is to reduce its dependence on the production of crude oil as the primary source of national income. Under the third five-year development plan (1980-85) the garget was for industry to generate 12% of the GDP. It is already responsible for more than 13%.

Saudi Arabia's industry includes oil-related industries and non-oil related businesses.

Oil industries depend on oil refining and gas operation. In 1982 refined products amounted to 310.9 million barrels, equal to 13% of crude oil production.

Today there are six producing refineries in the kingdom, with a total capacity of 900,000 barrels a day. A private sector is being encouraged by the government to invest in medium-scale blending plants, and seven products have been licensed by the Ministry of Industry and Electricity. In addition to this, Saudi Arabia has implemented six natural gas liquefying centres, raising the gas production from 11% in 1970 to 28% in 1980.

The non-oil industries include hydrocarbon-based and energy-intensive primary industries such as petrochemicals, fertilisers and iron and steel. The Saudi Basic Industries Corporation (SABIC), a government corporation, is responsible for these industries. Their strategy is of further expansion of a number of secondary industries which use the primary outputs as their raw materials to manufacture additional products such as plastics, paints, insulation, anti-freeze, adhesives, reinforcing bars and even some refined appliances.

There is no doubt that the private sector has played a major role in industry. There are now over 1,600 private factors with a total finance cost of £5.4 billion employing 92,000 workers, of which more than 20% are Saudi Arabian. The products of these factories include paints, carpets, metal galvanisers, land levellers, oilfield valves, cement, paper and textiles, as well as food processing such as dairy ice cream, date packing, fish processing and other foodstuffs (confectionery, coffee, halawa and sesame oil).

In addition to this, many minerals are mined such as gold, iron, copper and phosphates, etc.

Trade; Exports: For more than a decade Saudi Arabia has been the world's leading crude oil exporter. Higher output combined with higher crude oil prices has led to a remarkable increase in the kingdom's export revenues during the 1970s and early 1980s, when oil export reached a peak. In 1981 oil output for about half the year was over 10 million barrels a day, bringing in around £67,000 million. In 1982 oil exports fell sharply and brought in only £45,000 million, 33% less than the revenues of the previous year and about 25% less than in 1980 (CCI, 1985).

Oil products such as petrochemicals and fertilisers are also exported to more than 60 countries in the world (the recorded sales for 1986 were £4 billion). There are 2,000 factories which produce more than 10,000 varied products (Arab News, 1987). Saudi Arabia not only exports oil but also wheat, being the world's sixth largest exporter (2 million tons in 1986) (Al-Yom, 1988).

Imports: In general Saudi Arabia is very dependent on imports, although these have been scaled down following the decline in oil revenues and the fall in the national income. Imports have also been cut by the imposition of new customs duties, of which the highest (20%) were on those goods whose equivalents were produced in Saudi Arabia. This reduction, which was greater than that in exports, brought about a trade surplus estimated at £12.5 billion in 1984 (compared with that of £11.9 billion in 1983). Most of the imports in 1984 are shown in Table 1.6A.

TABLE 1.6A

Saudi Arabian imports in 1984

Imported Items	% of Total Value of Imports
Food and animals	13.6%
Beverages and tobacco	1.3%
Animal & vegetable oils, fats & waxes	0.4%
Goods & articles	0.9%
Manufactured articles	24.2%
Transport equipment & machinery	36.9%

Other articles include beef, canned fruits, vegetables, garments and footwear, with foodstuffs accounting for almost 13% of imports in 1982.

1.4. Education

Government sponsored public education is free at all levels, with separate schools for boys and girls. The goal of the government education policy is to provide a basic minimum education for the largest possible number of students and to encourage those who desire higher education to obtain it within the country or abroad. The government appropriations for education in 1983-84 were over £4.3 billion, compared to the sum of £3.5 billion in 1980-81. The growth in education facilities and students between 1980-81 to 1983-84 are shown in Tables 1.7A and 1.8A.

TABLE 1.7A

The growth in educational institutions in Saudi Arabia from 1980-81 - 1983-4

Type of Institution	1980-81	1983-84
Kindergarten schools	195	377
Primary schools	5,744	7,259
Intermediate schools	1,539	21,098
Secondary schools	513	803
Facilities	55	71
Teacher training institutes	132	20
Technical education schools	30	33
Special educational institutes	25	26
Adult education schools	2,991	3,014
TOTAL	11,224	13,701

TABLE 1.8A

The growth in the number of students in Saudi Arabia from 1980-81 - 1983-84

Type of Institute	Number of Students					
	Male	Female	Total	Male	Female	Total
Kindergarten schools	15,670	12,375	28,045	26,212	20,985	47,194
Primary schools	570,406	360,030	930,436	276,281	490,323	116,604
Intermediate schools	168,567	88,157	256,764	212,042	123,317	335,359
Secondary schools	65,873	34,150	100,023	88,209	58,772	146,981
Facilities	37,532	16,070	53,593	50,937	28,404	79,342
Teacher training inst.	10,097	10,900	20,997	11,107	6,289	17,391
Technical ed. schools	6,920	-	6,920	10,746	-	10,746
Special ed. inst.	1,432	539	1,971	1,554	817	2,371
Adult ed. schools	88,935	47,168	136,103	78,554	59,824	138,378

In 1979 the literacy rate was about 30%. In the past many of the people, particularly the Bedouins and those who lived in small villages, had never seen a book other than the Quran. Traditionally a high proportion of villagers would keep their children in the fields to work. Also, movements of the bedouins from one place to another deprived their children of an opportunity for education.

The Ministry of Education provides various services to combat illiteracy throughout the country such as night schools, summer campaigns, educational programmes on television, social service centres and public libraries.

APPENDIX II

TABLES FOR CHAPTER 2

TABLE 2.1A

Gravida and baby's head size

Baby's head size (cm)	Gravida 1-4 N	%	≥5 N	%	Total N	%
≤35	80	94	42	81	122	89
>35	5	6	10	19	15	11
TOTAL	85	100	52	100	137	100

$p < 0.02$.

APPENDIX III

DATASHEET OF FACTORS INFLUENCING PREGNANCY OUTCOME (STUDY I)

Study I: **Data sheet of factors influencing pregnancy outcome**

No of attendance	No of admission	Name	Age	Maternal ht (cms)	Gestational age (wks)	Gravida	Para	Living children	Hb level 1st visit (gm/dl)	Hct level 1st visit (gm %)	Date of blood test	No of visits to antenatal clinic	Mother's condition during pregnancy

Hb level before delivery (gm/dl)	Hct level before delivery (gm %)	Date of delivery	Date of discharge	Name of baby	Baby's sex	Baby's length at birth (cm)	Date of discharge	Head circumference (cm)	Chest circumference (cm)	Baby's weight (kg)

APPENDIX IV

QUESTIONNAIRE ON FOOD HABITS OF PREGNANT WOMEN IN SAUDI ARABIA (STUDY II)

STUDY II **Questionnaire on Food Habits of Pregnant Women in Saudi Arabia**

General Information

1. Name of Pregnant Woman ____________________ Age ______

2. File number ____________________

3. Address ____________________ Telephone No.

____________________ __________

4. Date of Interview ____________________

Medical Information

5. Age at the Marriage (yrs) ____________________

6. Age at the 1st Pregnancy (yrs) ____________________

7. Gestational age (wks) ____________________ LNMP _____

8. Gravida (no.) ____________________

9. Para (no.) ____________________

10. Number of Living Children and their Order, Sex & Age ____________________

Order of Children	Sex	Age
1st child		
2nd child		
3rd child		
4th child		
5th child		
etc.		

11. Number of Dead Children ____________________

12. How many times did you have miscarriage? (no.)

____

13. In which pregnancies did you have a miscarriage? (no.)

____

14. Weight at 1st visit to clinic ____________________

15. Height at 1st visit to clinic ____________________

16. Haemoglobin level at 1st visit to clinic __________

17. Haematocrit level at 1st visit to clinic __________

18. Were you taking any medications or vitamins before this visit to the clinic?

    ____________ YES ____________ NO

19. If YES, what kind do you take?

Iron only	_________	Folic acid + multivit.	_________
Folic acid only	_________	Vitamin A	_________
Multivit. only	_________	Zinc	_________
Iron + folic acid	_________	Nothing	_________
Iron + folic acid + multivit.	_________	Others (specify): ______________________ ______________________	

20. Did you take any traditional medicine and herbs to help you to become pregnant?

    ____________ YES ____________ NO

21. If YES, what is it? ______________________________________

    ____

22. Since you thought you were pregnant have you been taking any traditional medicine or herbs?

    ____________ YES ____________ NO

23. If YES, what is it? ______________________________________

    ____

Food Habits

24. Has your pregnancy affected your appetite?

_______ No, normal

_______ Yes, low

_______ Yes, more

_______ Unknown

_______ Others (specify)

25. Have you felt well during pregnancy?

_______ YES _______ NO

26. If NO, what problem do you have during pregnancy?

Problem	Times per day	Times per week
Nausea		
Vomiting		
Nausea + Vomiting		
Constipation/Indigestion		
Heartburn		
Others (specify)		
No Problem		

27. Have you experienced any food craving?

_______ YES _______ NO

28. If YES, what is the food?

Tabula	_______	Sweets	_______	Figs	_______
Salty food	_______	Cake	_______	Apple	_______
Spicy food	_______	Chocolate	_______	Juices	_______
Rice	_______	Coffee powder	_______	Carrot	_______
Fish	_______	Peach	_______	Salads	_______
Cheese	_______	Lemon	_______	Others (specify)	

____

29. What do you believe would happen if you did not eat the food which you crave?

__________ print birth marks

__________ baby will die

__________ nothing happen

__________ I don't know

__________ no answer

______________________________ others (specify)

30. Are there any foods that you have stopped eating since you become pregnant?

__________ YES __________ NO

31. What food have you stopped eating, and why?

Food Item	Bad to eat during pregnancy	Nausea	Vomiting	Nausea + Vomiting	Heartburn	Unpleasant Smell	Don't Know	Others

32. Have you experienced any craving for non-foods?

__________ mud

__________ soap

__________ clay

__________ coal

__________ toothpaste

__________ nothing

______________________________ others (specify)

PREGNANT WOMAN DIETARY RECALL

What foods did you eat yesterday?

Meal	Time	Ingredients	Amount	Whom eating with	Place
Breakfast					
Snack					
Lunch					
Snack					
Supper					
Snack					

FOOD FREQUENCY

Food Item	Once a day	Twice a day	3 Times a day	Once a week	Twice a week	3 Times a week	Once a month	Twice a month	3 Times a month
Liver (specify)									
Kidney (specify)									
Beef									
Lamb									
Eggs									
Beans									
Spinach									
Green pepper									
Cabbage									
Potatoes									
Fresh orange									
Orange juice									
Fresh lemon									
Lemon juice									
Fresh grapefruit									
Grapefruit juice									
Fresh tomatoes									
Tomato juice									
Strawberries									
Dried apricots									
Raisins									

33. Do you drink milk?

____________ YES ____________ NO

34. If YES, what kind of milk do you drink, and how often?

Type of Milk	Always	Often	Sometimes
Cow's milk			
Goat's milk			
Camel's milk			
Evaporated milk			
Powdered milk			
Other (specify)			

35. How do you take your milk?

________ plain

________ mixed with tea

________ mixed with coffee

________ mixed with chocolate

________ mixed with mahalabia

________ mixed with fruits

____________________________ other (specify)

36. Do you eat fermented milk products?

____________ YES ____________ NO

37. If YES, what kind of milk do you drink, and how often?

Type of Fermented Milk	Always	Often	Sometimes
Leben (buttermilk)			
Yoghurt			
Lebeneh			

39. Who ordinarily plans meals, does the shopping, prepares and cooks the foods in your house?

Person	Planning	Supplying	Preparing	Cooking
Housewife				
Husband				
Mother-in-law				
Sister-in-law				
Housewife's mother				
Housewife + mother				
Housewife + mother-in-law equally				
Housewife + sister-in-law equally				
Housewife + m-i-l + s-i-l equally				
Husband's father				
Cook				
Maid				
Other (specify)				

39. Do you have a garden at home to provide you with fresh vegetables and fruits?

_____________ YES _____________ NO

40. Do you have friends or relatives who provide you from their garden with fresh vegetables and fruits?

_____________ YES _____________ NO

41. Do you raise chickens to use their meat and eggs?

_____________ YES _____________ NO

42. How often do you plan your meals?

_________ no planning

_________ I plan when I shop

_________ I plan at the time of cooking

_________ I plan for next meal

_________ I plan for one day

_________ I plan for more than one day

______________________________ Other (specify)

43. In your household how often is the food cooked?

_________ Food for all meals cooked at the same time

_________ At two times

_________ Freshly cooked each time

______________________________ Other (specify)

44. What kind of stove do you have?

_________ gas stove

_________ electric stove

_________ kerosene

______________________________ Other (specify)

45. How many meals and snacks do you eat each day?

_________ meals

_________ snacks

______________________________ Other (specify)

46. Way of serving:

Women and men together _________

Women and men separately _________

Husband and wife separate from other members _________

Every member separately _________

Head of the family separate from other members _________

47. In your household, do you usually eat --- ?

_________ on the floor

_________ at the table

______________________________ Other (specify)

48. Do you eat from ---?

_________ the same dish

_________ separate dishes

______________________________ Other (specify)

49. Way of eating food ---?

_________ with spoon

_________ with hand

_________ with knife & fork

50. Foods that you believe are good for pregnant women, and why.

Food Item	Increase blood	Nutritious food fetus	Benefit to mother &	For growth of fetus health	Promote mother's	None	Don't know	Other reason
Milk								
Cheese								
Egg								
Buttermilk								
Fruits								
Vegetables								
Cereals								
Rice								
Macaroni								
Bread								
Meat								
Chicken								
Sweets								
Cakes								

51. What is the most important source of this information about the good food for pregnant women?

School _________

Parent (mother) _________

Friends _________

Relatives _________

Parent + friends _________

Parent + relatives _________

Friends + relatives _________

Doctor _________

TV _________

Radio _________

Newspapers, magazines, books

____

Housewife's experience

____

Other (specify)

____

52. Foods that you believe are bad for pregnant women.

Food Item	Causes undesirable effect on fetus	Causes abdominal distension	Causes headache	Causes heartburn	Causes miscarriage	Don't know	Other
Spicy food							
Sour food							
Salty food							
Sweet food							
Food rich in fat & oil							
Legumes							
Melons							
Onions							
Leeks							
Radishes							
Other (specify)							

53. What is the most important source of this information about bad food for pregnant women?

School ________ Doctor ________

Parent (mother) ________ TV ________

Friends ________ Radio ________

Relatives ________ Newspapers, magazines, books ________

Parent + friends ________

Parent + relatives ________ Housewife's experience ________

Friends + relatives ________

Other (specify) ________________

54. Should a woman change the amount of food she eats?

________ Yes, less

________ Yes, more

________ No, normal

Other (specify) ________________

55. If YES, what are the reasons for this change?

__________ prevent difficulty in delivery

__________ food for fetus growth

__________ eating for two

__________ advised to do it

__________ customs & traditions

__________ feel ill

__________ not known

____________________________ Other (specify)

56. If a pregnant woman becomes ill, should she eat differently?

__________ fasting

__________ eat less

__________ normal diet

__________ follow doctor's orders

__________ don't know

____________________________ Other (specify)

57. Who is going to look after you after delivery?

__________ husband

__________ mother

__________ sister

__________ mother-in-law

__________ sister-in-law

__________ relatives

__________ neighbours

__________ maid

____________________________ Other (specify)

58. Do you think it is important to eat special foods during the confinement period?

_____________ YES _____________ NO

59. If YES, what are these foods, and why?

Food Item	Why (reason)

60. What method are you going to use for feeding your baby, and why?

Method	Reason
Breast feeding only Bottle feeding only Mixed fed Other	

61. At what age do you think you will need to give your baby other feeds?

_________ months

62. What sort of foods will you give him first of all?

____

63. How will you give them?

_________ finger

_________ spoon

_________ mixed in bottle

_______________________________________ Other (specify)

Socio-Economic Information

64. Housewife's educational level

_________ illiterate

_________ read only

_________ read + write

_________ elementary

_________ intermediate

_________ secondary

_________ institute

_________ university

_________ postgraduate

65. Husband's educational level

_________ illiterate

_________ read only

_________ read + write

_________ elementary

_________ intermediate

_________ secondary

_________ institute

_________ university

_________ postgraduate

66. Housewife's occupation

_________ housewife

_________ housewife + clerk

_________ housewife + profession

_________ clerk only

_________ profession only

Other (specify)

____

67. Husband's occupation

_________ labourer

_________ clerk

_________ profession

_________ soldier

_________ businessman

_________________________________ Other (specify)

68. Type of accommodation

_________ owned

_________ rented

_________ share with husband's family

_________ share with her family

_________________________________ Other (specify)

APPENDIX V

TABLES FOR CHAPTER 5

TABLE 5.1A

Mean energy intake in three trimesters during the three study periods

Trimester (weeks)	Shaban M ± SD	Ramadan M ± SD	Shawal M ± SD	Total M ± SD
1 (<13)	1436 ± 712	1111 ± 561	1205 ± 586	1273 ± 644
2 (13-24)	1339 ± 450	972 ± 414	1442 ± 553	1246 ± 520
3 (25-36)	1388 ± 374	1039 ± 535	1498 ± 718	1275 ± 549
MEAN ± SD	1404 ± 615	1035 ± 509	1319 ± 589	1264 ± 644

($p<0.05$)

TABLE 5.2A

Mean protein intake in three trimesters during the three study periods

Trimester (weeks)	Shaban M ± SD	Ramadan M ± SD	Shawal M ± SD	Total M ± SD
1 (<13)	64 ± 36	40 ± 25	71 ± 48	60 ± 40
2 (13-24)	63 ± 25	45 ± 34	74 ± 42	61 ± 37
3 (25-36)	63 ± 28	33 ± 11	64 ± 43	51 ± 30
MEAN ± SD	65 ± 35	40 ± 28	72 ± 45	59 ± 38

($p<0.000$)

TABLE 5.3A

Mean fat intake in three trimesters during the three study periods

Trimester (weeks)	Shaban M ± SD	Ramadan M ± SD	Shawal M ± SD	Total M ± SD
1 (<13)	56 ± 34	38 ± 26	48 ± 28	48 ± 31
2 (13-24)	48 ± 21	34 ± 20	58 ± 28	47 ± 25
3 (25-36)	56 ± 24	39 ± 32	60 ± 38	50 ± 31
MEAN ± SE	54 ± 31	36 ± 24	53 ± 29	48 ± 29

($p < 0.002$)

APPENDIX VI

FOOD DICTIONARY

Food Items	Definition
Hesso, sawida and rashofa	All herbs
Mataziz (Saudi pizza)	Wheat flour, vegetables, tomato, onion, meat, spice, oil, salt and water
Methipak	Flour, ghee, syrup, fenugreek powder and coconut
Helbah	Fenugreek seeds
Halawa	Sesame tehinah, sugar, glucose
Thareed	Meat, onion, fresh tomatoes, tomato paste, vegetables, oil, salt, spices, bread (rakak or baladi), water
Boiled rice	Rice, onions, salt, oil, water
Maraq Samek (fish stew)	Fish, onions, fresh tomatoes, tomato paste, garlic, oil, salt, spices, dried lemon, water
Maraq Dajaj (chicken stew)	Same as fish stew, but using chicken
Mahamer (rice + sugar)	Rice, sugar, oil, butter, water, saffron
Mahalabia	Wholemilk (liquid), sugar, rice flour, vanilla, cardamon
Markok	Meat, fresh tomatoes, tomato paste, vegetables, garlic, onion and wheat dough
Kabsa	Meat, rice, fresh tomatoes, onions, vegetables (carrots, peas), oil, salt, spices, water
Legimate	Flour, yeast, salt, water, little sugar, oil. Syrup: sugar, water, lemon juice, cardamon, saffron
Keema	Minced meat, onions, fresh tomatoes, tomato paste, spices, garlic, oil, salt, dried lemon and sometimes vegetables
Hareesa	Meat, blanched wheat, salt, butter, water, cinnamon
Jereesh	Meat, crushed wheat, fresh tomatoes, tomato paste, onions, oil, salt, spices, water, dried lemons
Aseeda	Wheat flour, sugar, butter, cardamon, water. Topping: eggs, salt, spices, oil, onion
Lentil soup	Lentils (red), water, onion, spices, oil, dried lemon

Food Items	Definition
Foul moudamus	Broad beans, water, salt, oil, lemon juice, garlic, tomato and onions
Baba gannuj (eggplant dip)	Fried eggplant, garlic, salt, tehineh, lemon juice, water
Kofta	Ground meat (beef or lamb), chopped onion, chopped parsley, salt, spices, egg, flour, oil
Sleeq	Rice, milk, chicken soup and water
Leben	Buttermilk
Malokhia	Jew's mallow, onion, chicken, spices and water
Rashad	Watercress

APPENDIX VII

A: QUESTIONNAIRE ON MATERNAL FOOD HABITS AND INFANT FEEDING PRACTICES IN SAUDI ARABIA (STUDY III)

B: TABLES FOR CHAPTER 7

APPENDIX VIIA

STUDY III **Questionnaire on Maternal Food Habits and Infant Feeding Practices in Saudi Arabia**

First Visit - General Information

1. Mother's Name ____________________ Age __________
2. File No. ____________________ Tel No. __________
3. Address ____________________

   ____

4. Date of Interview ____________________

Medical Information

5. Age at the marriage (year) __________
6. Age at the 1st pregnancy (year) __________
7. Gravida (no.) __________
8. Parity (no.) __________
9. Number of living children __________
10. Number of dead children __________
11. Number of abortions __________
12. Interval birth between youngest & next __________
13. Mother's cooperation during study (YES/NO) __________

General Information relating to youngest child

14. Baby's sex (MALE/FEMALE) __________
15. Baby's age at time of interview (months) __________
16. Infant feeding __________ breast milk

    __________ bottle milk

    __________ mixed milk

17. Baby's health condition

    __________ healthy

    __________ ill

Information on the next oldest child

18. Child's sex (MALE/FEMALE) ____________

19. Child's age (months) ____________

Information on oldest (1st) child

20. Child's sex (MALE/FEMALE) ____________

21. Child's age (years/months?) ____________

22. (see next page)

23. Who is taking care of you during puerperium? ____________

24. Who is cooking for you during this period? ____________

25. Are you carrying out any domestic tasks in the household? (YES/NO) ____________

26. (see following pages)

27. Was this a typical day? (YES/NO) ____________

28. If NO, how was it different? ____________________

____

28. After the delivery how long was it before you ate or drank anything, and why?

Time Period	To give mother rest	Mother is	Custom	Not known	Others
0-8 hrs					
9-24 hrs					
25-48 hrs					
49-96 hrs					
Not known					
Other (specify)					

29. What was the first thing that you ate/drank? ____________

30. Why do people do this? ____________

31. How soon after delivery was the baby given anything to eat or drink?

_________ Immediately

_________ Within 6 hours

_________ Within 12 hours

_________ Within 24 hours

_________ Within 72 hours

32. What was the first thing that was given to the newborn, and why?

Type of Food	**Cleansing**	**Custom**	**Regain strength**	**Prepares baby to receive milk**	**Easy to digest**	**No maternal milk**	**Not known**	**Others**
Warm water								
Warm water + sugar								
Honey								
Butter & oils								
Herb tea								
Breast milk								
Milk formula								
Not known								
Others (specify)								

33. How long did you remain in hospital after delivery? _________ days

34. Was the baby kept in the same room as the mother? _________ yes

_________ no

_________________________ other (specify)

35. Did the medical staff encourage you to breast feed? _________ yes

_________ no

_________________________ other (specify)

36. Did they encourage you to feed your baby

_________ on demand

_________ according to schedule

_________ according to maternal inclination

37. Were free milk samples given to you in hospital? _________ yes

_________ no

_________________________ other (specify)

38. Was a free feeding bottle also given to you in hospital?

_________ yes

_________ no

_________________________ other (specify)

39. How are you feeding your baby at the moment?

_________ breast feeding only

_________ bottle feeding only

_________ mixed feeding

_________________________ other (specify)

40. When is the feed given? _________ on demand of the baby

_________ according to schedule

_________ according to maternal inclination

41. Source of recommendation to use this method of feeding?

Mother	_________	TV	_________
Old woman	_________	Radio	_________
Relatives	_________	Press	_________
Friends	_________	Hospital	_________
Previous experience	_________	Clinic	_________
Muslim teaching	_________	Doctor	_________
Self-observation of others	_________	Nurse	_________

Other (specify) _________________________

42. Were your feeding practices different from those of your mother?

_________ yes

_________ no

_________ don't know

____________________ other (specify)

43. How is it different? ____________________

44. Do you feed your baby anything else in addition to milk during this age?

_________ yes

_________ no

____________________ other (specify)

45. If YES, what is it, and why?

____

____

46. Did your baby have diarrhoea during the last four weeks?

_________ yes

_________ no

_________ don't know

____________________ other (specify)

47. If YES, how long did the diarrhoea last? (in days)

_________ still continuing

_________ one day

_________ two days

_________ three days

_________ four days

_________ five days

_________ six days

_________ seven days

_________ eight days

____________________ other (specify)

48. What did you feed the baby during the diarrhoea?

- ________ tea
- ________ starch water
- ________ rice water
- ________ breast milk
- ________ doctor's prescription
- ________ distilled water
- ____________________ other (specify)

49. Where was the baby treated?

- ________ at home
- ________ by doctor
- ________ in hospital
- ________ in health centre
- ____________________ other (specify)

Information on Infant Feeding

If bottle fed or mixed fed go to Questions 58 and 75 respectively
If breast fed to go Question 50

Information on breast feeding

50. What are the reasons for choosing breast feeding?

- Natural thing to do ________
- Nourishing, clean, healthy for infant ________
- Mother has plenty of milk ________
- Less expensive and convenient ________
- Demands less time ________
- Provides love and closeness between infant and mother ________
- Religious teaching ________
- No reason ________
- I don't know ________
- Other (specify) ____________________

51. Do you eat special foods during lactation, and if so why?

Food preferred	Increase milk secretion	Nutritional food	Habit	Promote mother's health	Promote infant's health	None	I don't know	Other

52. Do you avoid special food during lactation, and if so why?

Food avoided	Harmful to infant	Harmful to mother	Spoils breast milk	Gas producing	Causes diarrhoea in infant	Habit	None	I don't know	Others

53. How much should a feeding mother eat or drink?

_________ normal amount

_________ less than normal

_________ more than normal

_________________ other (specify)

54. At the moment, how many times do you breast feed your baby each day?

_________ times

55. How long should a breast feeding mother continue to feed her baby, and why?

____

56. If the mother is ill, should she continued to breast feed, and why?

	Illness affects child	Child gets ill	Mother has no milk	Child needs milk	Custom	Someone else's milk won't affect child	Less milk given	Not known	Others
Yes									
No									

57. What a baby is ill, should a mother continue to breast feed, and why?

	Child needs milk	Gives baby rest	Milk causes sickness	Not known	Others
Yes					
No					

Bottle Feeding

58. What is the reason for choosing bottle feeding?

_________ It's good and I can afford the cost of bottle feeding

_________ Bottle feeding better than breast feeding

_________ Bottle feeding is convenient

_________ No breast milk

_________ Breast & nipple problems

_________ Work

_________ Others (specify)

59. What kind of milk do you feed your baby?

_________ Goat's milk

_________ Fresh cow's milk

_________ Dried baby powdered milk

_________ Evaporated milk

_________ Others (specify)

60. If it is powdered baby milk do you always use the same brand?

_________ yes

_________ no

61. What is the brand? _____________________

62. Who brings (buys) it? _____________________

63. How many spoons of powdered milk do you put in the bottle?

_________ spoons

64. Do you boil the water for making up the milk?

Always	_________	Never	_________
Sometimes	_________	Others (specify)	_________

65. How many spoons of powdered milk do you put in the bottle feeding?

_________ spoons

66. How often do you wash the baby's bottle?

_________ times

67. Do you sterilize the baby's bottle?

_________ yes

_________ no

68. How do you sterilize the baby's bottle?

_________ Boiling bottle after each use

_________ Boiling bottle daily

_________ Boiling bottle twice a day

_________ Other method (specify)

69. How do you make up the feeds?

_________ One at a time as needed

_________ In batches, specify number

70. How do you store them (batches)?

____

71. How do you give your baby his bottle?

_________ in his bed

_________ holding him

____________________ other (specify)

72. If some milk remained in the bottle at the end of a feed, what would you do with it?

_________ keep it in refrigerator

_________ leave it at room temperature

_________ throw it away

____________________ other (specify)

73. If the baby is ill, would you change the way in which you feed him/her?

_________ yes

_________ no

____________________ other (specify)

74. If YES, in what way do you change feeding your baby?

____

Mixed Feeding

75. What are the reasons for choosing breast and bottle feeding together?

_________ breast feeding is not enough

_________ work

____________________ other (specify)

76. When do you give breast milk or bottle milk to your baby?

____

____

77. How often do you breast feed your baby?

____

78. How often do you bottle feed your baby?

____

79. What kind of bottle milk do you feed your baby?

_________ goat's milk

_________ fresh cow's milk

_________ dried baby powdered

_________ evaporated milk

____________________ other (specify)

80. If it is powdered baby milk, what is the brand?

____

81. Do you boil the water for making up the milk?

_________ always

_________ sometimes

_________ never

____________________ other (specify)

82. How do you sterilize baby's bottle feeding?

_________ boiling bottle after each use

_________ boiling bottle daily

_________ boiling bottle twice a day

_________ not boil the bottle

____________________ other (specify)

83. How many bottles do you make up at a time for each feed?

_________ one at a time as needed

_________ batches, specify number

84. How do you store them (batches)?

____

85. How do you give your baby his bottle?

_________ in bed

_________ holding him

____________________ other (specify)

86. If some milk remained in the bottle at the end of a feed, what do you do with it?

_________ keep in refrigerator

_________ leave at room temperature

_________ throw it away

_________________ other (specify)

Socio-Economic Information

87. Mother's educational level:

_________ illiterate

_________ read only

_________ read and write

_________ elementary

_________ intermediate

_________ secondary

_________ institute

_________ university

_________ postgraduate

88. Husband's educational level:

_________ illiterate

_________ read only

_________ read and write

_________ elementary

_________ intermediate

_________ secondary

_________ institute

_________ university

_________ postgraduate

89. Mother's occupation:

_________ housewife

_________ housewife + clerk

_________ housewife + profession

_________ clerk only

_________ profession only

_________________ other (specify)

90. If you are working, did you receive post-delivery paid leave?

Yes ________ No ________

91. What is the duration of leave? ________ weeks

92. Husband's occupation: ________ labourer

________ clerk

________ profession

________ soldier

________ businessman

________________ other (specify)

93. Type of accommodation: ________ owned

________ rented

________ share with husband's family

________ share with mother's family

________________ other (specify)

<u>Anthropometric Measurements (mother)</u>

94. Mother's name ________________

95. Mother's height (cm) ________

96. Mother's weight (kg) ________

97. Mother's skinfold thickness: ________ triceps

________ biceps

________ subscapular

________ suprailiac

98. Have you been ill at all since the baby was born?

Yes ________ No ________

Anthropometric Measurements (infant)

99. Infant's name ____________________

100. Infant's age (months) ________

101. Sex Male ________ Female ________

102. Infant's length (cm) ________

103. Infant's weight (kg) ________

104. Infant's mid-arm circumference (cm) ________

105. Infant's head circumference (cm) ________

THANK YOU FOR YOUR COOPERATION

Second Visit

Questionnaire the same as Questionnaire I for Questions 1-17, 23-28, 40-41, 45-50, 60-73, 76-107, in addition to the following questions

1. How are you feeding your baby now?

Breast only	________	(go to Q8)
Continuing bottle only	________	(go to Q3)
Changed from breast to bottle only	________	(go to Q6)
Continuing breast + bottle	________	
Changed from breast to breast + bottle	________	
Changed from breast + bottle to bottle only	________	

2. How many times do you feed your baby (from breast milk or bottle milk) on average during a 24 hour period?

________ breast (times)

________ bottle (times)

3. Bottle only (continuing) and breast + bottle (continuing):

Have you changed the baby milk since last time?

Yes ________ No ________ (go to Q8)

4. If YES, why have you changed?

____

5. What type of milk are you using now?

______________________________ (go to Q8)

Changed from Breast only to Bottle only, or Breast only to Breast + Bottle feeding:

6. Why did you change your method of feeding?

_________ no breast milk

_________ breast & nipple problems

_________ return to work

_________ new pregnancy

_________ sickness (of mother)

_________ child refusal of mother's milk

_________ sickness of child

_________ medication or contraceptive use

_________ others

7. How did you make the change?

Gradually _________ Abruptly _________

All Mothers:

8. Have you offered any supplemental foods to your baby during the last two months? At what age, and how is his/her response?

Food	**Age**	**Response**

9. Did you feed your baby anything else apart from milk, regularly?

Yes _________ No _________

10. If YES, what is it?

____

Third Visit

Questionnaire same as for Questionnaire 2, in addition to the following questions:

1. How do you give this food to your baby?

   ________ by cup and spoon

   ________ by cup only

   ________ by bottle feeding

   ________ by hand (mother)

   ________ by hand (child)

   ________ by chewing by mother

2. Have you started weaning your baby since last two months?

   ________ yes

   ________ no

   ________________ other (specify)

3. If YES, at what age did you start weaning him/her?

   ________ 6 months

   ________ 6½ months

   ________ 7 months

4. Is the weaning process? ________ gradual

   ________ abrupt

   ________________ other (specify)

5. If the weaning process is gradual, then at what age are you going to wean your baby totally?

   ________ months

6. Why do you wean your baby at this age?

_________ baby is big enough

_________ infant illness

_________ mother illness

_________ new pregnancy

_________ doctor's advice

_________ infant refused to bottle feed

_________ infant refused to breast feed

_________ breast & nipple problems

_________ baby is eating food

_________ breast or bottle feeding takes long time

_________ cost of bottle feeding is high

_________ breast milk is not enough

_________ medication or contraceptive use

_________ work

_________ my husband says so

_________ no reason

_________ others

7. What is the method used by you for weaning purposes?

_________ painting nipples with black pepper

_________ painting nipples with sabra murra

_________ hiding bottle from baby

_________ separating infant from mother

_________ introducing other food gradually

_________ introducing other food abruptly

_________ nothing was used

_________ others

8. If you haven't weaned your baby yet, then when do you expect to start weaning him/her?

_________ months (infant age)

9. Has your baby got teeth?

Yes _________ No _________

Fourth Visit

Questionnaire same as Questionnaire 3, in addition to the following questions:

1. When are you going to wean your baby totally?

_________ months (infant age)

And why at this age?

____

____

____

APPENDIX VIIB

TABLE 7.1A

Relationship between the number of miscarriages and mother's education

	Mother's Education: Illiterate N	Illiterate %	Literate N	Literate %	Total N	Total %
No misses	11	55	26	84	37	73
1 or 2 misses	9	45	5	16	14	27
TOTAL	20	100	31	100	51	100

TABLE 7.2A

Special attributes of selected foods by pregnant women for puerperium period (Study II)

Food	N	Attribute
Fenugreek	21	Strengthen back (95%) Clean uterus (95%)
Rashad	17	Clean uterus (100%)
Aseeda	11	Clean uterus (100%)
Hassa rice	7	Clean uterus (86%) Strengthen back (71%)
Liver	6	Replace blood loss (100%)
Sawida	5	Clean uterus (100%)
Mataziz	5	Strengthen back (80%)
Rashofa	4	Clean uterus (50%)
Hesso	3	Strengthen back (100%)
Chicken soup	3	Clean uterus (67%)
Markok	1	Clean uterus (100%)
Black pepper	1	Clean body of gas (100%)
Quinine	1	Calm the stomach (100%)

TABLE 7.3A

Special attributes of selected foods by mothers during confinement (Study III)

Food	Attribute
Aseeda	Strengthen back, tradition
Fenugreek	Strengthen body and back, clean uterus
Rashad	Strengthen back, clean uterus
Meat & chicken soups	Strengthen body, nutritious
Markok	Strengthen body, tradition
Sawida	Strengthen back, clean uterus
Hassa rice	Strengthen body and back, nutritious
Milk & leben	Strengthen body and back, nutritious
Vegetables & chicken	Strengthen body, nutritious
Hesso	Strengthen body and back, tradition

TABLE 7.4A

Mean nutrient intakes at First Visit

	Mother (23)	Other (21)	Herself (7)
Total Calories	1885	2011	1581
Protein	73	86	73
Protein (%E)	19	28	30
Fat	75	74	66
Fat (%E)	35	32	36
CHO	178	182	148
CHO (%E)	37	36	37
Thiamin	0.8	0.75	0.8
Riboflavin	1.6	1.8	2.6
Niacin	19	18	20
Iron	13	21	21
Calcium	1091	1328	1146
Vitamin B_{12}	2.0	2	3.7
Vitamin B_6	2.0	2.0	2.0
Vitamin A	519	416	592
Vitamin C	66	65	66
Fibre	6	5	6

TABLE 7.5A

Mean nutrient intakes at Second Visit

	Other (9)	Herself (42)
Total Calories	1481	1745
Protein	66	74
Protein (%E)	21	27
Fat	51	70
Fat (%E)	34	36
Carbohydrate	167	157
Carbohydrate (%E)	42	34
Thiamin	0.7	0.8
Riboflavin	1.3	1.9
Niacin	21	20
Iron	16	19
Calcium	1127	1222
Vitamin B_{12}	1.6	2.0
Vitamin B_6	1.6	1.8
Vitamin A	398	572
Vitamin C	73	61
Fibre	7.0	5.0

APPENDIX VIII

TABLES FOR CHAPTER 8

TABLE 8.1A

Effect of Feeding Type on the Mother's Weights

Type of Feeding	1st visit		2nd visit		3rd visit		4th visit	
	N	M ± SD	N	M ± SD	N	M ± SD	N	M ± SD
Breast	(26)	62.6 ± 14.0	(26)	62.3 ± 13.5	(26)	63.3 ± 13.9	(26)	64.0 ± 13.3
Bottle	(6)	67.8 ± 11.8	(6)	69.6 ± 13.7	(6)	70.4 ± 16.5	(6)	70.2 ± 16.7
Mixed	(2)	73.6 ± 19.0	(2)	73.0 ± 19.0	(2)	73.5 ± 17.7	(2)	74.2 ± 17.5

TABLE 8.2A

Effects of Feeding Type on the Mother's Biceps Skinfold Thickness

Type of Feeding	1st visit		2nd visit		3rd visit		4th visit	
	N	M ± SD	N	M ± SD	N	M ± SD	N	M ± SD
Breast	(26)	9.6 ± 4.0	(26)	10.0 ± 3.2	(26)	10.3 ± 4.0	(26)	10.9 ± 3.9
Bottle	(6)	10.9 ± 5.0	(6)	12.3 ± 5.2	(6)	13.4 ± 5.3	(6)	15.2 ± 7.0
Mixed	(2)	13.4 ± 7.0	(2)	13.0 ± 6.9	(2)	13.4 ± 5.9	(2)	14.2 ± 6.0

TABLE 8.3A

Effect of Feeding Type on the Mother's Triceps Skinfold Thickness

Type of Feeding	1st visit		2nd visit		3rd visit		4th visit	
	N	M ± SD	N	M ± SD	N	M ± SD	N	M ± SD
Breast	(26)	18.8 ± 5.7	(26)	18.6 ± 5.9	(26)	19.9 ± 6.0	(26)	20.0 ± 6.3
Bottle	(6)	20.0 ± 4.4	(6)	22.5 ± 4.0	(6)	23.5 ± 6.0	(6)	24.0 ± 7.3
Mixed	(2)	23.0 ± 11.3	(2)	22.7 ± 11.0	(2)	23.3 ± 10.0	(2)	23.6 ± 10.0

TABLE 8.4A

Effects of Feeding Type on the Mother's Subscapular Skinfold Thickness

Type of Feeding	1st visit		2nd visit		3rd visit		4th visit	
	N	M ± SD	N	M ± SD	N	M ± SD	N	M ± SD
Breast	(26)	21.6 ± 8.0	(26)	22.3 ± 7.7	(26)	23.4 ± 8.0	(26)	24.0 ± 8.0
Bottle	(6)	24.7 ± 2.5	(6)	26.0 ± 3.6	(6)	27.0 ± 6.0	(6)	29.0 ± 7.0
Mixed	(2)	34.9 ± 16.8	(2)	34.8 ± 16.7	(2)	34.8 ± 16.0	(2)	35.3 ± 16.0

TABLE 8.5A

Effects of Feeding Type on the Mother's Body Mass Index

Type of Feeding	1st visit		2nd visit		3rd visit		4th visit	
	N	M ± SD	N	M ± SD	N	M ± SD	N	M ± SD
Breast	(26)	26.7 ± 5.6	(26)	26.6 ± 5.0	(26)	27.3 ± 5.3	(26)	27.0 ± 4.0
Bottle	(6)	27.5 ± 4.7	(6)	28.3 ± 5.0	(6)	28.5 ± 6.0	(6)	28.5 ± 6.4
Mixed	(2)	33.5 ± 8.0	(2)	33.2 ± 8.0	(2)	33.5 ± 7.0	(2)	33.8 ± 7.3

APPENDIX IX

TABLES FOR CHAPTER 9

TABLE 9.1A

Percentage distribution of length for age in SD scores of the NCHS reference population

Age (months)	GRADE OF STUNTING						Total
	Stunted		Normal length		Tall		
	N	%	N	%	N	%	
1	8	16	38	72	6	12	51
3	13	25	29	57	9	18	51
6	7	14	36	70	8	16	51
9	12	23	30	59	8	16	51

TABLE 9.2A

Percentage distribution of weight/length in SD scores of the NCHS reference population

Age (months)	GRADE OF WASTING						Total
	Wasted		Normal weight		Overweight		
	N	%	N	%	N	%	
1	6	12	39	76	6	12	51
3	6	12	33	65	12	23	51
6	16	31	29	57	6	12	51
9	13	26	30	59	8	16	51

TABLE 9.3A

Percentage distribution of weight/length and length/age SD scores of the NCHS reference population at First visit

	Wasted		Normal weight		Overweight		Total	
	N	%	N	%	N	%	N	%
Stunted	1	2	5	10	2	4	8	16
Normal length	3	6	30	58	4	8	37	72
Tall	2	4	4	8	0	0	6	12
TOTAL	6	12	39	76	6	12	51	100

TABLE 9.4A

Percentage distribution of weight/length and length/age in SD scores of the NCHS reference population at Second visit

	Wasted		Normal weight		Overweight		Total	
	N	%	N	%	N	%	N	%
Stunted	0	0	6	12	7	13	13	25
Normal length	1	2	23	45	5	10	29	57
Tall	5	10	4	8	0	0	9	18
TOTAL	6	12	33	65	12	23	51	100

TABLE 9.5A

Percentage distribution of weight/length and length/age in SD scores of the NCHS reference population at Third visit

	Wasted		Normal weight		Overweight		Total	
	N	%	N	%	N	%	N	%
Stunted	1	2	3	6	3	6	7	14
Normal length	13	25	21	41	2	4	36	70
Tall	2	4	5	10	1	2	8	16
TOTAL	16	31	29	57	6	12	51	100

TABLE 9.6A

Percentage distribution of weight/length and length/age in SD scores of the NCHS reference population at fourth visit

	Wasted		Normal weight		Overweight		Total	
	N	%	N	%	N	%	N	%
Stunted	2	4	6	12	1	2	9	18
Normal length	7	13	21	41	7	14	35	68
Tall	4	8	3	6	0	0	7	14
TOTAL	13	25	30	59	8	16	51	100

TABLE 9.7A

Effects of feeding type on the infants' weights

Age (months)	Breast group N	Breast group Mean	Bottle group N	Bottle group Mean	Mixed group N	Mixed group Mean	Anova test F-value	Anova test SS
			WEIGHT					
1	38	4.1 ± 0.6	6	4.0 ± 0.5	7	3.4 ± 0.4	1.3	0.3
3	31	5.9 ± 0.8	9	5.9 ± 0.4	11	5.3 ± 0.4	2.7	0.1
6	28	7.5 ± 1.0	14	7.5 ± 0.7	9	6.9 ± 0.3	2.2	0.1
9	28	8.7 ± 1.0	15	8.8 ± 0.8	8	8.0 ± 0.5	1.9	0.2

TABLE 9.8A

Effects of feeding type on the infants' lengths

Age (months)	Breast group N	Breast group Mean	Bottle group N	Bottle group Mean	Mixed group N	Mixed group Mean	Anova test F-value	Anova test SS
			LENGTH					
1	38	54.1 ± 2.5	6	53.2 ± 1.9	7	53.1 ± 1.5	0.7	0.5
3	31	60.4 ± 3.0	9	59.3 ± 2.5	11	58.6 ± 3.0	1.4	0.2
6	28	67.4 ± 2.8	14	66.9 ± 1.7	9	67.1 ± 1.3	0.3	0.8
9	28	71.3 ± 2.7	15	70.8 ± 2.4	8	70.7 ± 2.6	0.2	0.8

TABLE 9.9A

Effects of feeding type on the infants' head circumferences

Age (months)	Breast group N	Breast group Mean	Bottle group N	Bottle group Mean	Mixed group N	Mixed group Mean	Anova test F-value	Anova test SS
	HEAD CIRCUMFERENCE							
1	38	37.0 ± 1.3	6	36.7 ± 1.2	7	36.3 ± 1.1	1.0	0.4
3	31	40.2 ± 1.4	9	40.3 ± 0.9	11	39.5 ± 1.0	1.4	0.3
6	28	42.9 ± 1.3	14	43.0 ± 0.8	9	42.1 ± 1.4	2.0	0.1
9	28	44.8 ± 1.5	15	44.8 ± 0.7	8	43.9 ± 1.0	1.5	0.2

TABLE 9.10A

Effect of feeding type on the infants' mid-arm circumference

Age (months)	Breast group N	Breast group Mean	Bottle group N	Bottle group Mean	Mixed group N	Mixed group Mean	Anova test F-value	Anova test SS
	MID-ARM CIRCUMFERENCE							
1	38	11.8 ± 0.9	6	11.5 ± 0.8	7	11.1 ± 0.7	2.6	0.08
3	31	13.5 ± 0.9	9	13.1 ± 0.9	11	12.9 ± 0.7	1.9	0.2
6	28	14.5 ± 0.9	14	14.4 ± 0.8	9	13.7 ± 0.7	2.8	0.07
9	28	15.3 ± 0.9	15	15.2 ± 0.8	8	14.6 ± 0.5	2.6	0.08

from a child under study can be compared with the percentiles of weight/age, weight/height and height/age from the reference population.

In the reference population, the 50th centile indicate the median weight at each age, e.g. 50% of children have weights less than this and the other 50% have weights above this. Similarly, weights located on the 3rd centile indicate that 3% of children have weights less than this value at each age, while 97% have weights above this. If a study child falls on or below the 3rd centile for the reference population for height/age, this is usually taken to indicate stunting; while if a study child falls on or below the 3rd centile for the reference population for weight/height, this is taken to indicate wasting.

3. Standard Deviation

Standard deviation is used to indicate the range or the spread of the observations about the mean. If the observations follow a normal distribution of weight/age or height/age or weight/height, then ± 1 SD above and below the mean should include about 68% of the observations. However, ± 2 SD above or below the mean would cover 95% of the observations, and ± 3 SD above and below the mean about 99.7% of the observations.

Children with weight/age or height/age or weight/height which deviated from the mean of the reference population by more than ± 2 SD are usually considered to have abnormal measurements.

The formula for calculating the standard deviation score for a child is:

$$SD = \sqrt{\frac{(x - x)^2}{n - 1}}$$

$(x - x)^2$ is the sum of the squares of the differences (or deviation) from the mean, and n is the total number of observations.

Use of Reference Standards in Anthropometric Assessment

The NCHS standards provide reference information about the average and distribution of weights and heights of children at each age.

When comparing a child with these standards it would be possible merely to calculate the difference from the standard. However, the actual difference in weight will vary in importance depending on the age and size of the child. For example, a 1 kg difference from the standard is more important in a 9 month old child where the standard is 7.9 kg than a 5 year old where the standard is 18.4 kg. For this reason, comparison of survey results with a reference standard is usually made in one of the following ways:

(1) Percentage of standard median

(2) Percentiles

(3) Standard deviations (Z-scores).

1. Percentage of the Standard Median

For example, the percentage of standard median weight for age is calculated by dividing the child's actual weight by the standard median for his/her age (months) multiplied by 100. A similar computation could be carried out to obtain for each child the percentage of standard median height for age and weight for height. This standard has been used by Waterlow and others to distinguish grades of malnutrition by using arbitrary cut-off points to identify children who fall outside an acceptable range, e.g. below 80% of the standard median for weight/height is considered wasting, while below 90% of the standard median for height/age is considered stunting.

2. Percentiles

Percentiles express in numerical form the distribution of measurements (weight and height) of children at different ages in the reference population. Data from a child under study can be compared with the percentiles of weight/age, weight/height and height/age from the reference population.

In the reference population, the 50th centile indicate the median weight at each age, e.g. 50% of children have weights less than this and the other 50% have weights above this. Similarly, weights located on the 3rd centile indicate that 3% of children have weights less than this value at each age, while 97% have weights above this. If a study child falls on or below the 3rd centile for the reference population for height/age, this is usually taken to indicate stunting; while if a study child falls on or below the 3rd centile for the reference population for weight/height, this is taken to indicate wasting.

3. Standard Deviation

Standard deviation is used to indicate the range or the spread of the observations about the mean. If the observations follow a normal distribution of weight/age or height/age or weight/height, then ± 1 SD above and below the mean should include about 68% of the observations. However, ± 2 SD above or below the mean would cover 95% of the observations, and ± 3 SD above and below the mean about 99.7% of the observations.

Children with weight/age or height/age or weight/height which deviated from the mean of the reference population by more than ± 2 SD are usually considered to have abnormal measurements.

The formula for calculating the standard deviation score for a child is:

$$SD = \sqrt{\frac{(x - x)^2}{n - 1}}$$

$(x - x)^2$ is the sum of the squares of the differences (or deviation) from the mean, and n is the total number of observations.